EMC
TEST REPORT

Report No.: TS10010016-EME
Model No.: T500, R360
Issued Date: Jan. 20, 2010

Applicant:	**Taiwan Jaio Co., Ltd.** **21F-2 No.83, Sec.1, Zhongxiao E. Rd., Taipei City 10049, 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**

The test report was prepared by:	Sign on File Shirla Hsiao / Officer
These measurements were taken by:	Sign on File Leon Cheng/ Engineer
The test report was reviewed by:	Rex Liao **Name** Rex Liao **Title** Engineer

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Summary of Tests

Beacon - Model: T500
FCC ID: X3WP1BC

Test	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:	Beacon
Model No.:	T500
FCC ID.:	X3WP1BC
Frequency Range:	2402 MHz ~ 2480 MHz
Channel Number:	79 channels
Frequency of Each Channel:	2402 + k MHz; k = 0~78
Type of Modulation:	FHSS (GFSK, π/4DPSK, 8DPSK)
Rated Power:	DC 5 V from adapter model: TC-FU-USB; I/P voltage: 100-240 Vac, 50/60 Hz
Power Cord:	N/A
Sample Received:	Jan. 04, 2010
Test Date(s):	Jan. 20, 2010 ~ Jan. 14, 2010
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 a Beacon, and was defined as information technology equipment.

The customer confirmed the different model numbers serve as marketing strategy. These models are identical in hardware aspect.

The differences between main model and series model are listed as below.

Model No.	Differences
T500	Standard Version with all features for US (pre-loaded with map information for US market)
R360	Rangefinder Version with simplified UI and less features for US (pre-loaded with map information for US market)

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 : 2dBi
Antenna Type : Ceramic antenna
Connector Type : N/A

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 were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT was supplied with DC 5 V from adapter (Test voltage: 120 Vac, 60 Hz) and the transmission mode was running in control “Bluetest” program.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30
Horn Antenna	SCHWARZBECK	1GHz~18GHz	BBHA 9120 D
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9168
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981
Pre-Amplifier	MITEQ	26GHz~40GHz	828825
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2495A/ MA2411A
Controller	HDGmbH	N/A	HD 100
Antenna Tower	HDGmbH	N/A	MA 240
Turn Table	HDGmbH	N/A	DS 420S
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5

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:	1023	hPa

3.2 Test setup & procedure

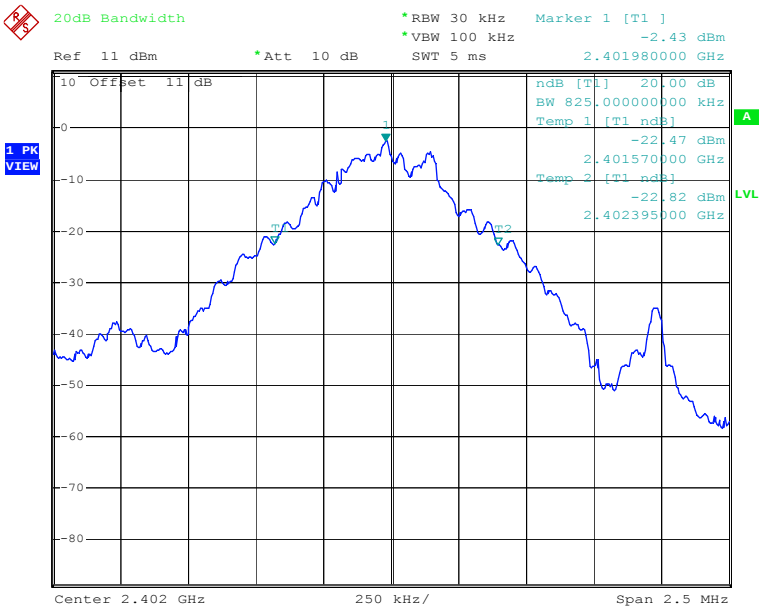
The test procedure was according to FCC measurement guidelines DA 00-705.
The 20dB bandwidth per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth≧RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. 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 (KHz)
GFSK	0	2402	825
	39	2441	880
	78	2480	805
π/4DPSK	0	2402	1230
	39	2441	1235
	78	2480	1230
8DPSK	0	2402	1260
	39	2441	1270
	78	2480	1260

Please see the plot below.

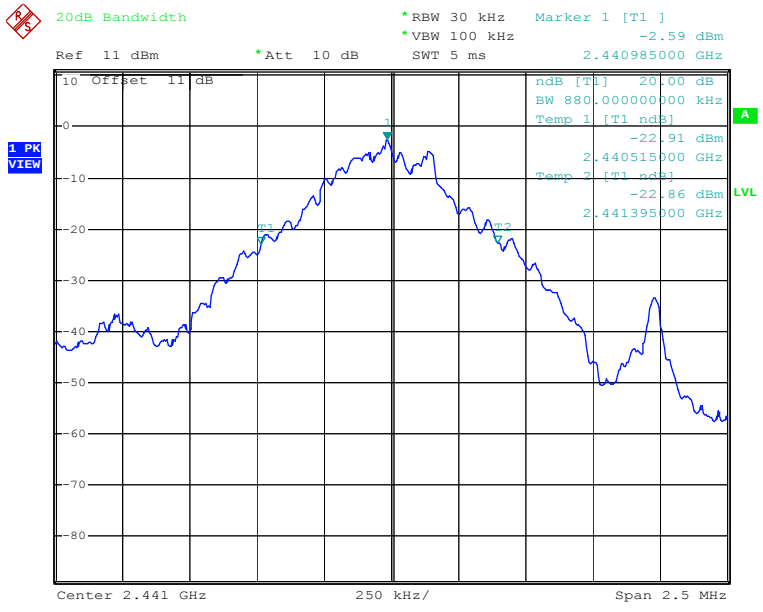
20 dB Bandwidth @ GFSK mode channel 0



CH 0 at Bluetooth mode GFSK

Date: 18.JAN.2010 09:47:17

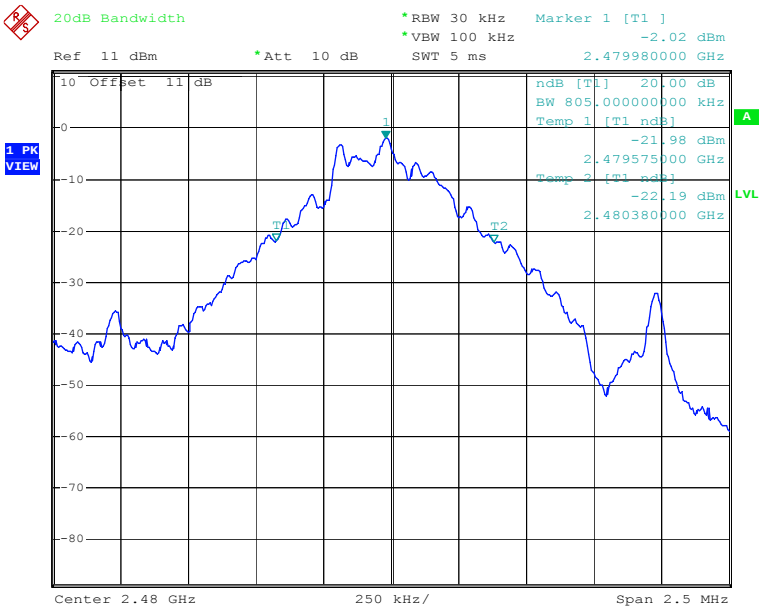
20 dB Bandwidth @ GFSK mode channel 39



CH 39 at Bluetooth mode GFSK

Date: 18.JAN.2010 09:48:53

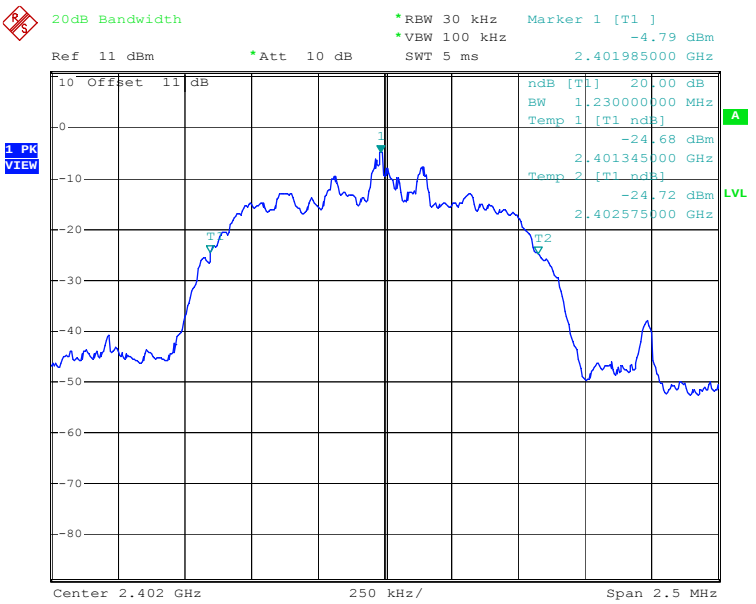
20 dB Bandwidth @ GFSK mode channel 78



CH 78 at Bluetooth mode GFSK

Date: 18.JAN.2010 09:51:49

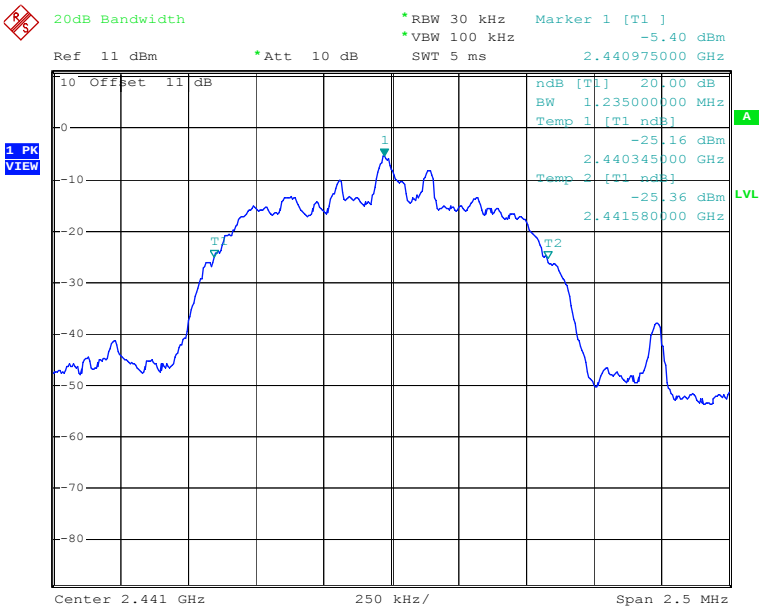
20 dB Bandwidth @ π/4DPSK mode channel 0



CH 0 at Bluetooth mode π /4 DPSK

Date: 18.JAN.2010 10:11:24

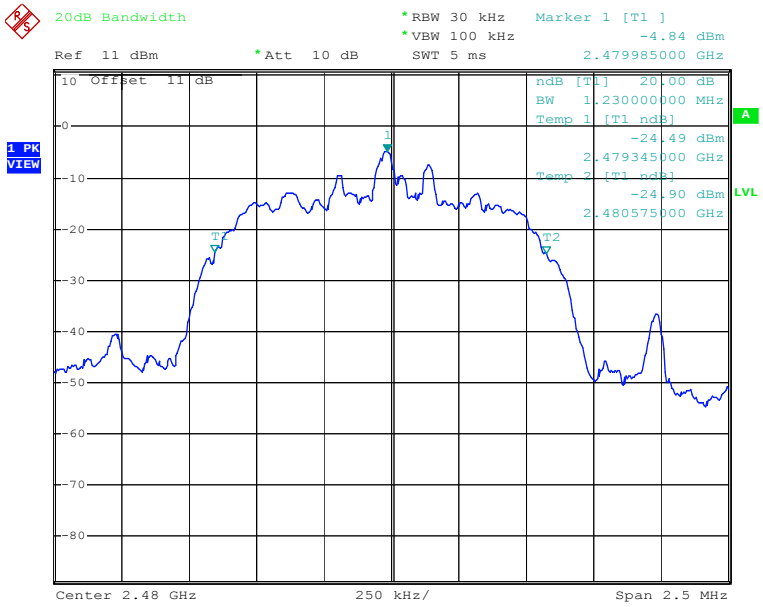
20 dB Bandwidth @ π/4DPSK mode channel 39



CH 39 at Bluetooth mode π /4 DPSK

Date: 18.JAN.2010 10:14:12

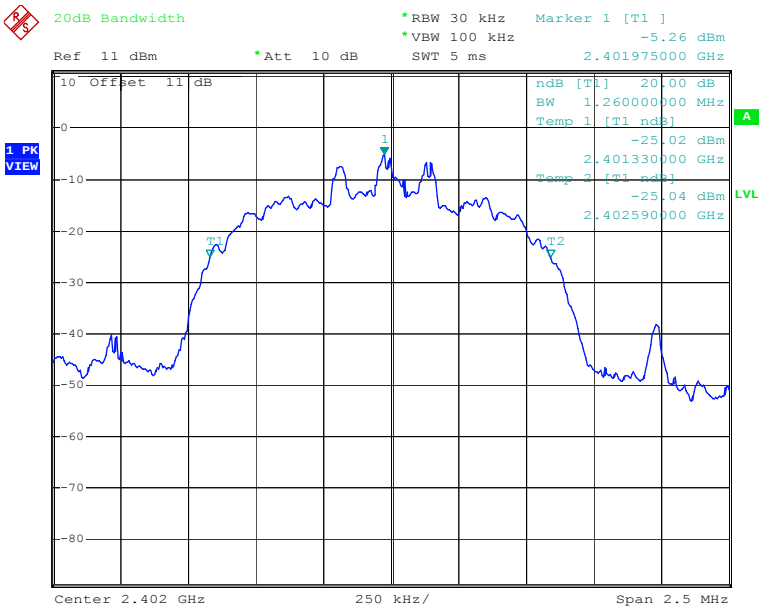
20 dB Bandwidth @ π/4DPSK mode channel 78



CH 78 at Bluetooth mode π /4 DPSK

Date: 18.JAN.2010 10:15:54

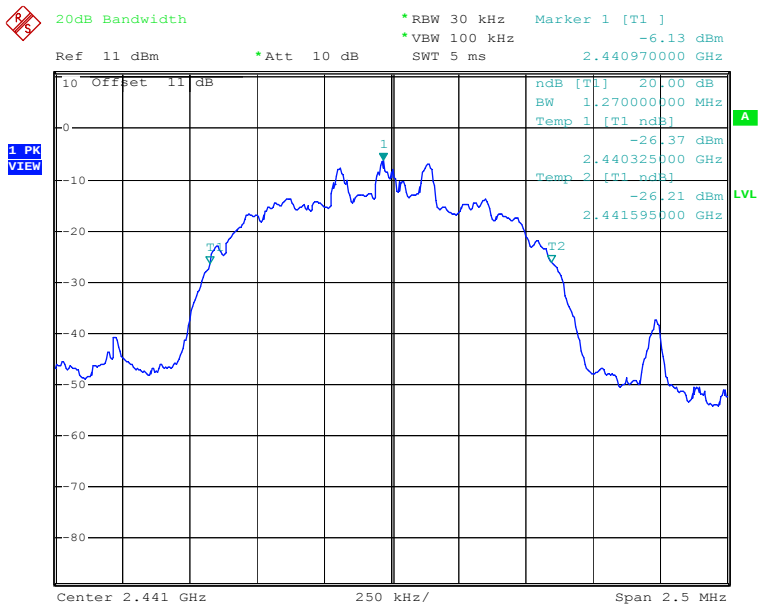
20 dB Bandwidth @ 8DPSK mode channel 0



CH 0 at Bluetooth mode 8DPSK

Date: 18.JAN.2010 10:19:33

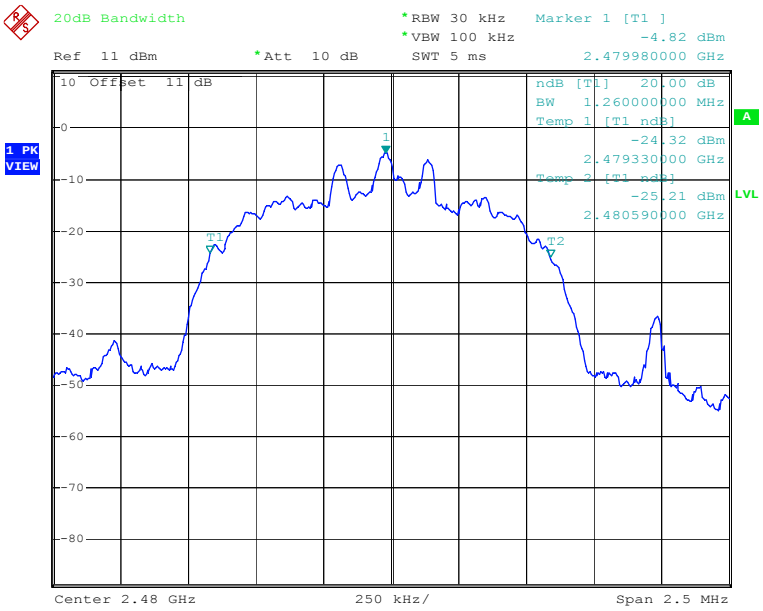
20 dB Bandwidth @ 8DPSK mode channel 39



CH 39 at Bluetooth mode 8DPSK

Date: 18.JAN.2010 10:21:51

20 dB Bandwidth @ 8DPSK mode channel 78



CH 78 at Bluetooth mode 8DPSK

Date: 18.JAN.2010 10:23:40

4. Carrier Frequency Separation test

4.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1023	hPa

4.2 Test setup & procedure

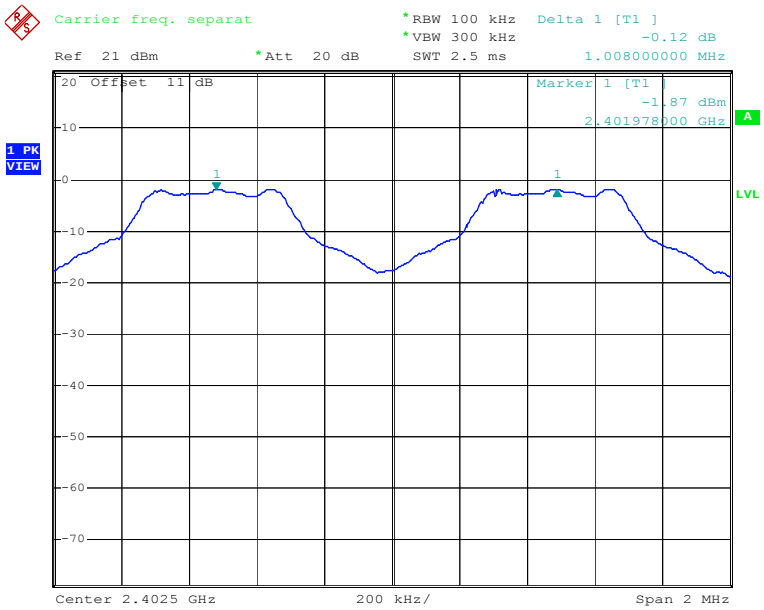
The test procedure was according to FCC measurement guidelines DA 00-705.
The carrier frequency separation per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1% of the span, the video bandwidth≧RBW, and the SPAN was wide enough to capture the peaks 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	1.008	586.67
	1	2403		
π/4DPSK	0	2402	1.004	823.33
	1	2403		
8DPSK	0	2402	1.004	846.67
	1	2403		

Please see the plot below.

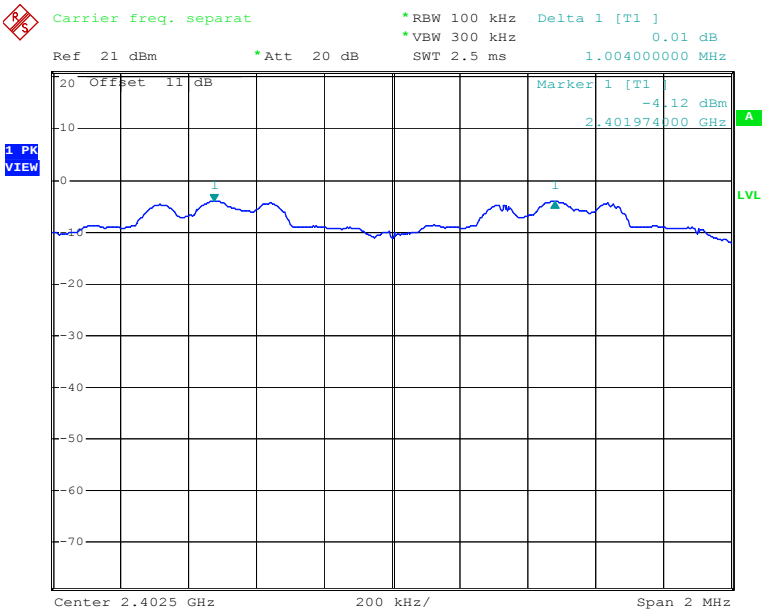
Carrier Frequency Separation @ GFSK mode



at Bluetooth mode GFSK

Date: 18.JAN.2010 09:28:06

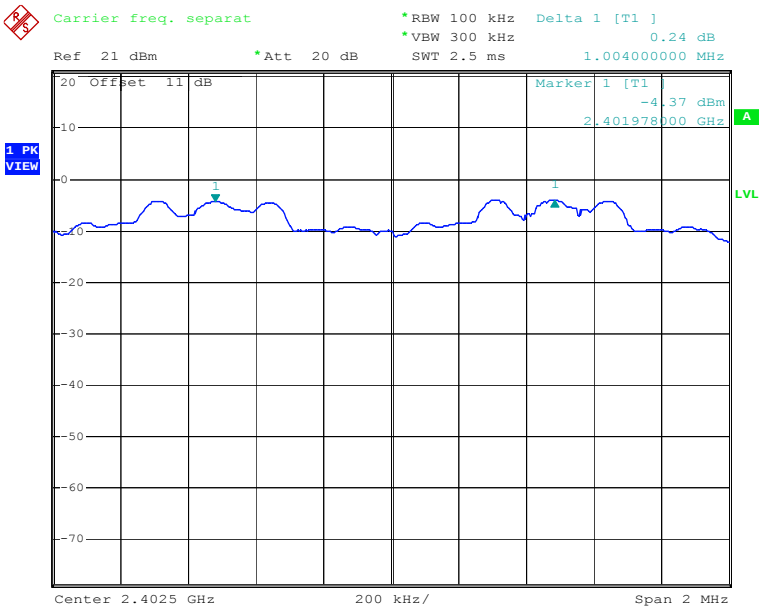
Carrier Frequency Separation @ π /4DPSK mode



at Bluetooth mode π /4-DPSK

Date: 18.JAN.2010 09:39:02

20 dB Bandwidth @ 8DPSK mode



at Bluetooth mode 8DPSK

Date: 18.JAN.2010 13:10:03

5. Number of hopping frequencies test

5.1 Operating environment

Temperature:	25	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1023	hPa

5.2 Test setup & procedure

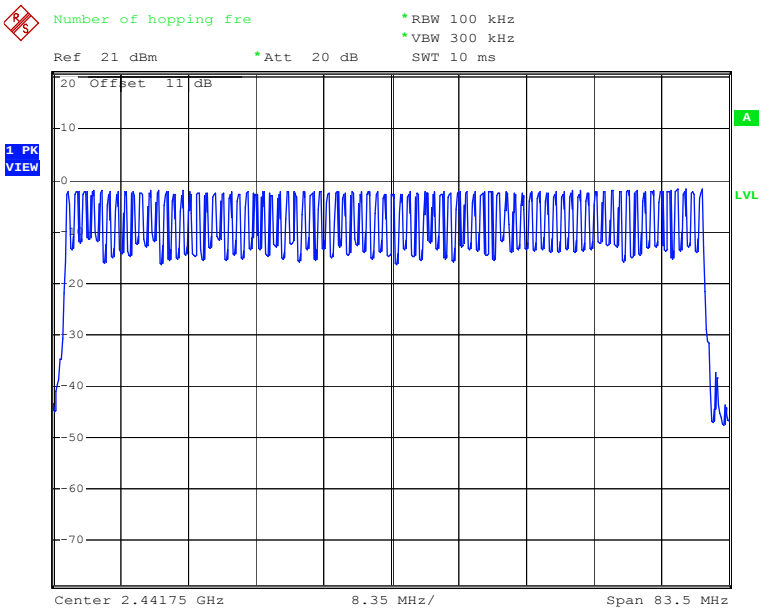
The test procedure was according to FCC measurement guidelines DA 00-705.
The number of hopping frequencies per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1% of the span, the video bandwidth≧RBW, and the SPAN was the frequency band of operation.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

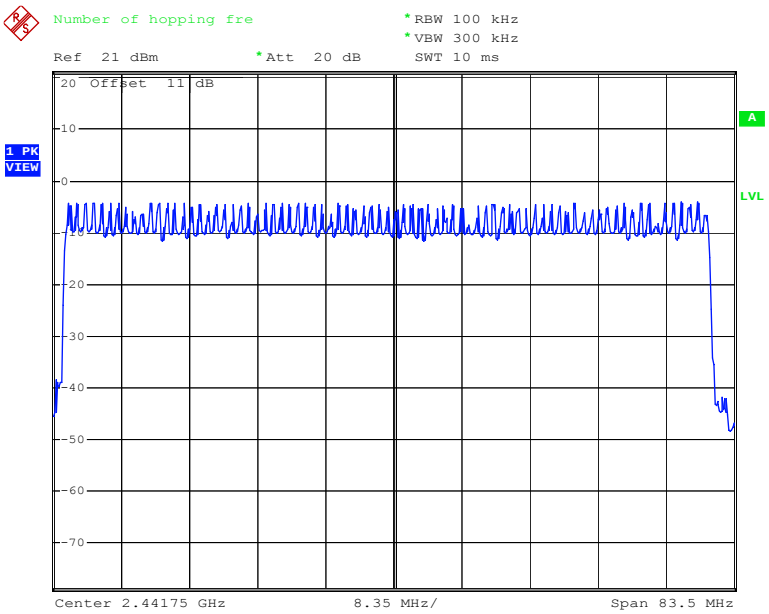
Number of hopping frequencies @ GFSK mode



CH 0 at Bluetooth mode GFSK

Date: 18.JAN.2010 11:13:05

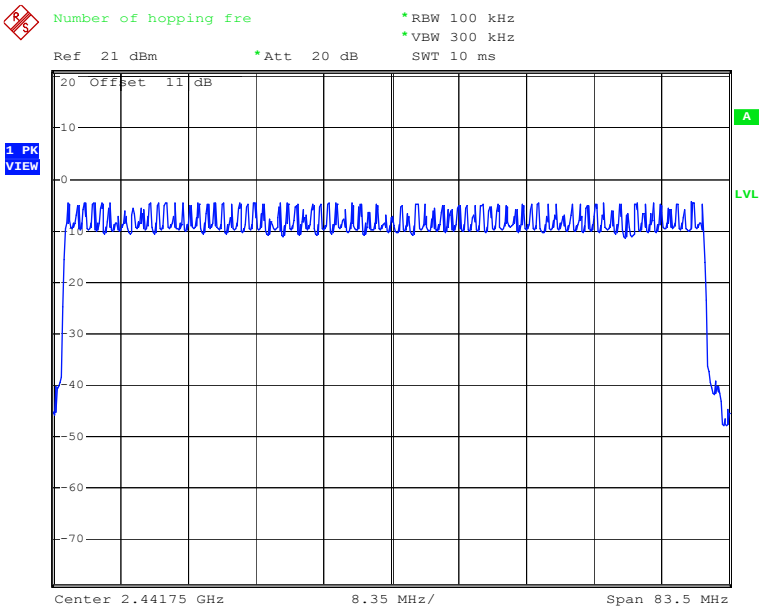
Number of hopping frequencies @ π /4DPSK mode



CH 0 at Bluetooth mode π /4DPSK

Date: 18.JAN.2010 11:19:50

Number of hopping frequencies @ 8DPSK mode



CH 0 at Bluetooth mode 8DPSK

Date: 18.JAN.2010 11:27:27

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

6.1 Operating environment

Temperature: 23 ℃
Relative Humidity: 55 %
Atmospheric Pressure: 1023 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.

Time of occupancy (dwell time) for DH1
hop rate = 1/2 * 1600 = 800
Dwell time = Pulse Width * 800Hz / 79 * 31.6sec

Time of occupancy (dwell time) for DH3
hop rate = 1/4 * 1600 = 400
Dwell time = Pulse Width * 400Hz / 79 * 31.6sec

Time of occupancy (dwell time) for DH5
hop rate = 1/6 * 1600 = 266.667
Dwell time = Pulse Width * 266.667Hz / 79 * 31.6sec

Mode	Mode	Pulse Width (ms)	Time of Occupancy (ms)	Limit (sec)
GFSK	DH1	0.421	134.72	0.4
	DH3	1.68	268.80	
	DH5	2.94	313.60	
π/4DPSK	DH1	0.438	140.16	0.4
	DH3	1.69	270.40	
	DH5	2.95	314.67	
8DPSK	DH1	0.431	137.92	0.4
	DH3	1.69	270.40	
	DH5	2.93	312.53	

Duty Cycle Correction Factor

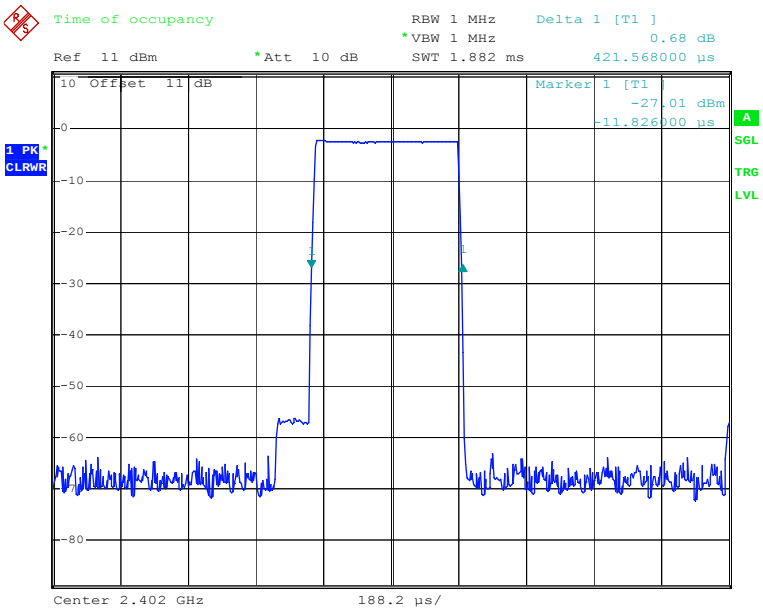
Mode	Mode	Time of Occupancy (ms)	Duty Cycle %	Duty Cycle Correction Factor (dB)
GFSK	DH1	134.72	0.426329	-47.41
	DH3	268.80	0.850633	-41.41
	DH5	313.60	0.992417	-40.07
π/4 DPSK	DH1	140.16	0.443544	-47.06
	DH3	270.40	0.855696	-41.35
	DH5	314.67	0.995793	-40.04
8DPSK	DH1	137.92	0.436456	-47.20
	DH3	270.40	0.855696	-41.35
	DH5	312.53	0.989042	-40.10

Remark:

1. Duty Cycle = (time of occupancy)/(31.6*1000)*100%
2. Duty Cycle Correction Factor = 20 log (duty cycle/100%)
3. The worst case of GFSK mode is –40.07
   The worse case of π/4 DPSK mode is –40.04
   The worse case of 8DPSK mode is –40.1

Please see the plot below.

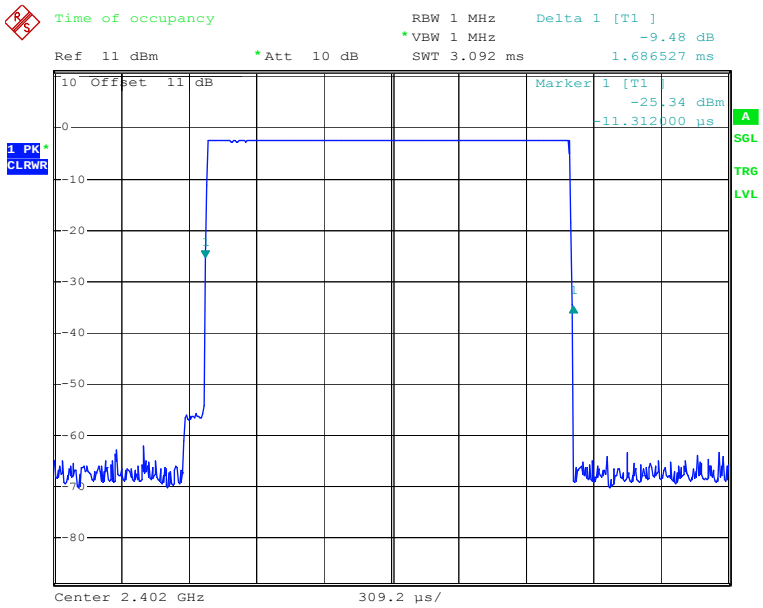
Dwell time @ GFSK mode DH 1



CH 0 at Bluetooth mode GFSK DH1

Date: 18.JAN.2010 11:02:22

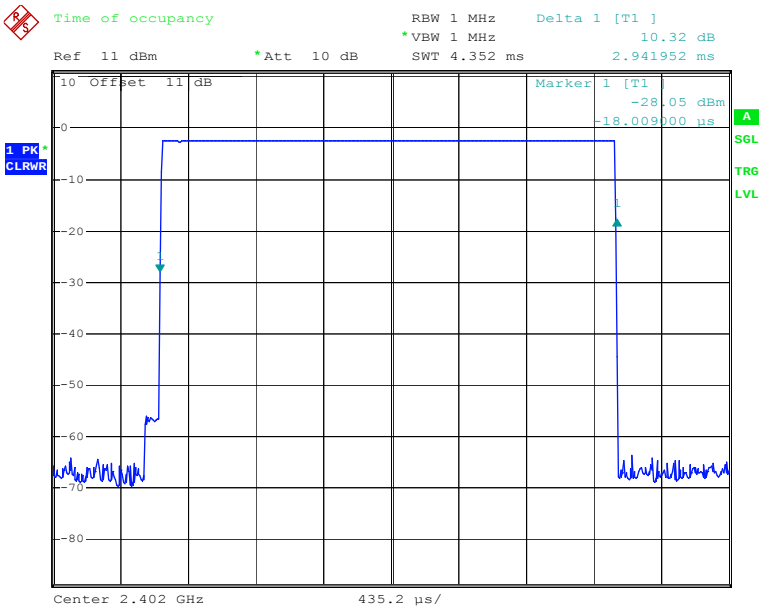
Dwell time @ GFSK mode DH 3



CH 0 at Bluetooth mode GFSK DH3

Date: 18.JAN.2010 10:58:58

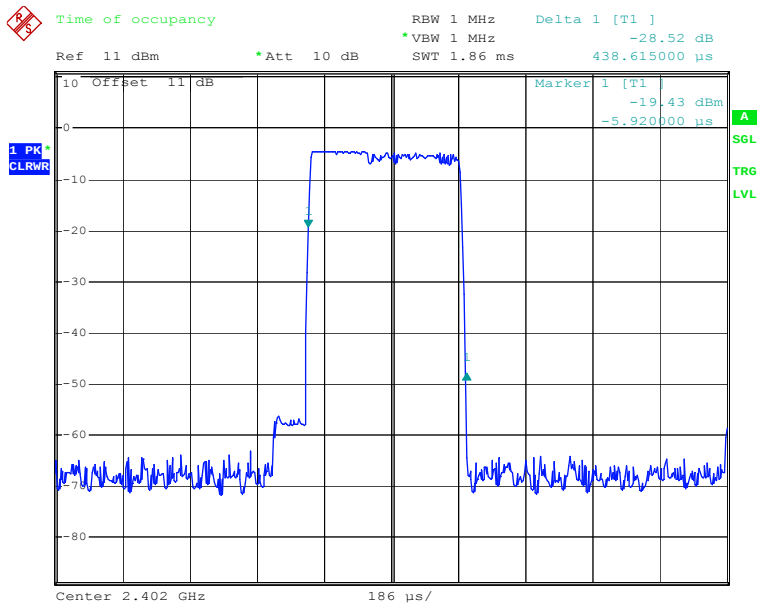
Dwell time @ GFSK mode DH 5



CH 0 at Bluetooth mode GFSK DH5

Date: 18.JAN.2010 10:55:35

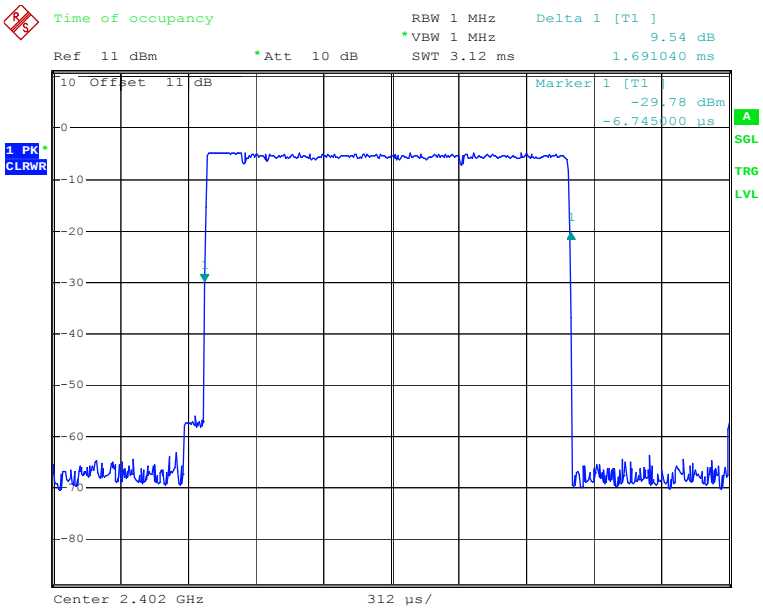
Dwell time @ π/4DPSK mode DH 1



CH 0 at Bluetooth mode π /4DPSK DH1

Date: 18.JAN.2010 10:39:56

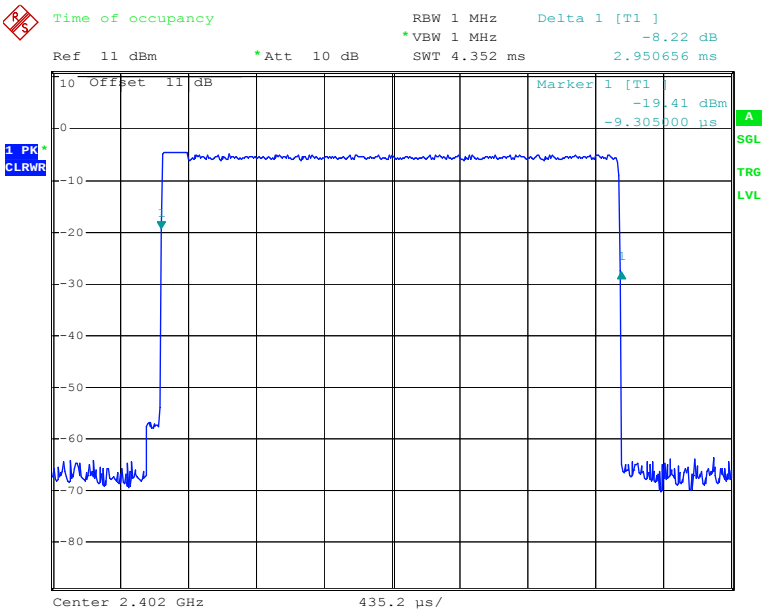
Dwell time @ π/4DPSK mode DH 3



CH 0 at Bluetooth mode π /4DPSK DH3

Date: 18.JAN.2010 10:49:24

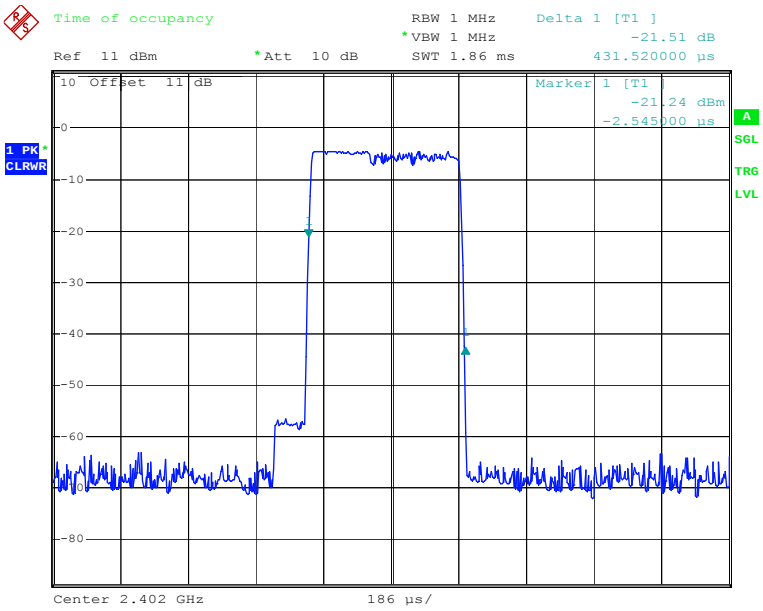
Dwell time @ π/4DPSK mode DH 5



CH 0 at Bluetooth mode π /4DPSK DH5

Date: 18.JAN.2010 10:52:40

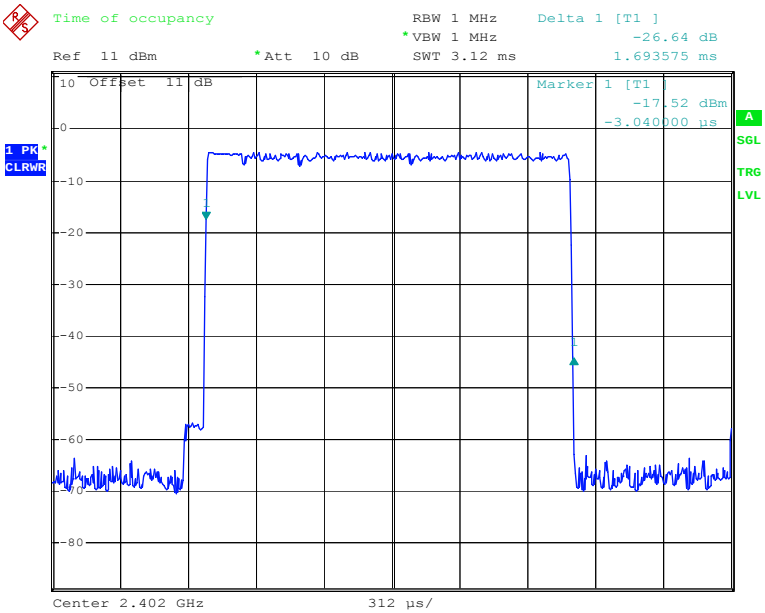
Dwell time @ 8DPSK mode DH 1



CH 0 at Bluetooth mode 8DPSK DH1

Date: 18.JAN.2010 10:37:17

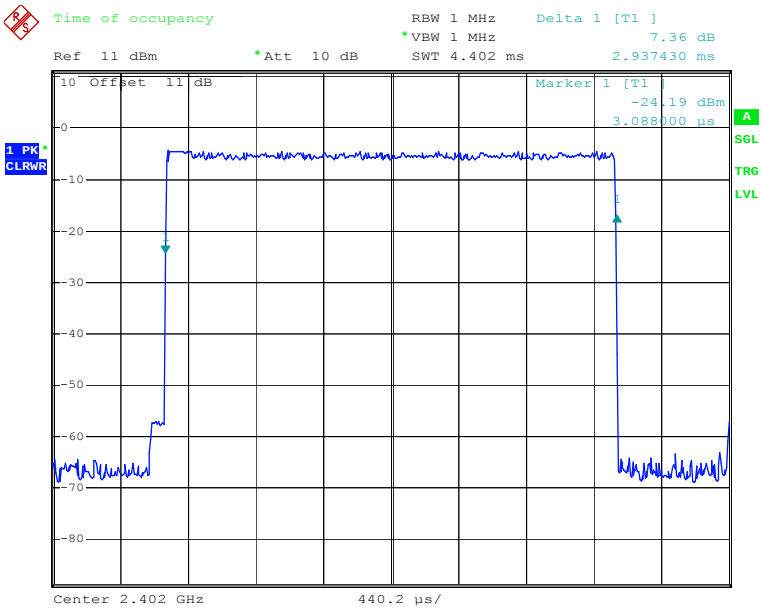
Dwell time @ 8DPSK mode DH 3



CH 0 at Bluetooth mode 8DPSK DH3

Date: 18.JAN.2010 10:35:30

Dwell time @ 8DPSK mode DH 5



CH 0 at Bluetooth mode 8DPSK DH5

Date: 18.JAN.2010 10:31:54

7. Maximum Output Power test

7.1 Operating environment

Temperature: 23 ℃
Relative Humidity: 50 %
Atmospheric Pressure: 1022 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 (MHz)	Output Power (PK) (dBm)	Total Power (PK) (mw)	Limit (dBm)
GFSK	0	2402	-1.50	0.71	21
	39	2441	-1.24	0.75	21
	78	2480	-0.74	0.84	21
π/4DPSK	0	2402	-3.08	0.49	21
	39	2441	-2.83	0.52	21
	78	2480	-2.49	0.56	21
8DPSK	0	2402	-2.84	0.52	21
	39	2441	-2.69	0.54	21
	78	2480	-2.36	0.58	21

8. RF Antenna Conducted Spurious test

8.1 Operating environment

Temperature:	25	℃
Relative Humidity:	58	%

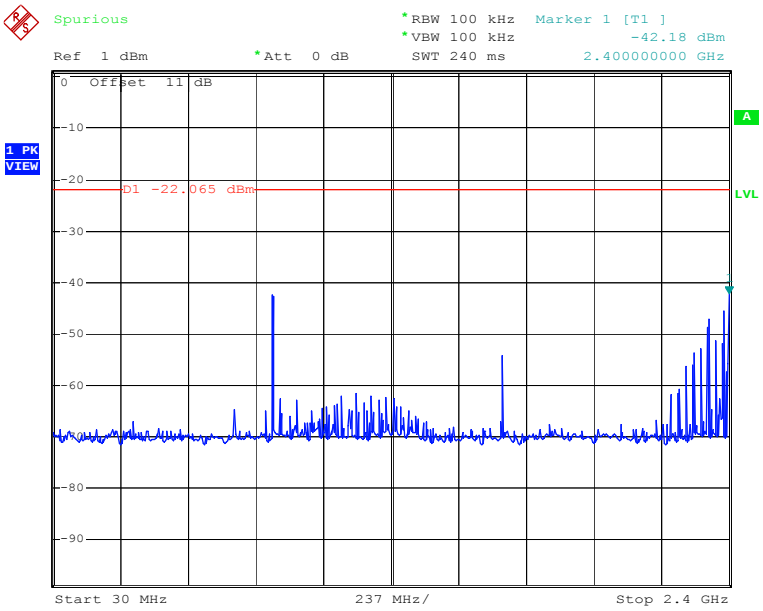
8.2 Test setup & procedure

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

The test results please see the plot below.

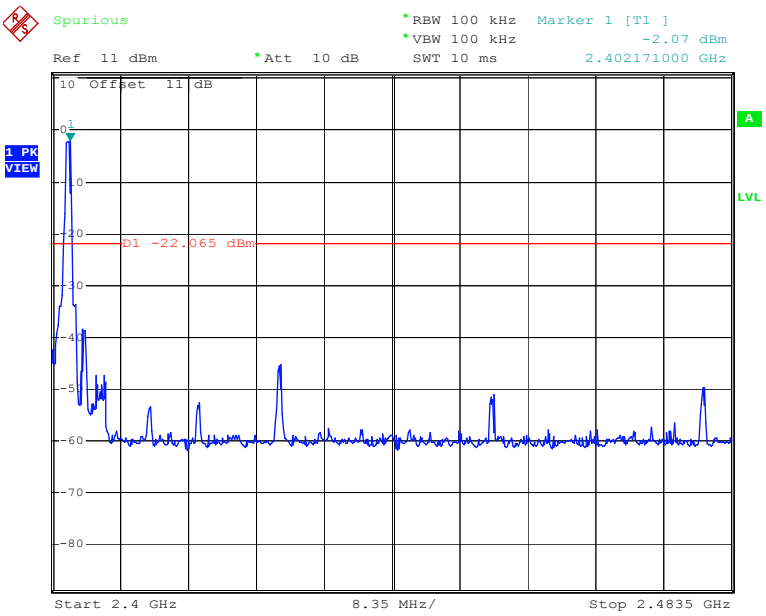
Conducted spurious @ GFSK channel 0 (1 of 3)



CH 0 at Bluetooth mode 30MHz~2400MHzGFSK

Date: 18.JAN.2010 12:41:50

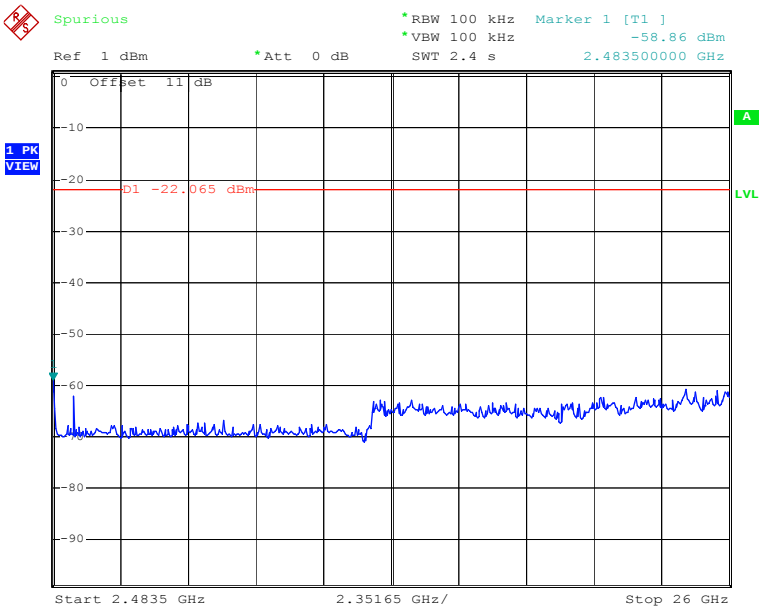
Conducted spurious @ GFSK channel 0 (2 of 3)



CH 0 at Bluetooth mode 2400MHz~2483.5MHzGFSK

Date: 18.JAN.2010 12:41:32

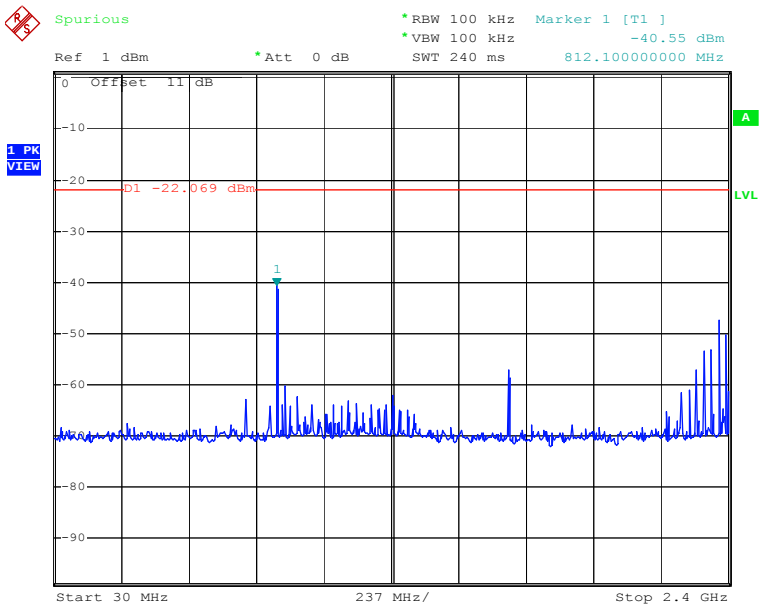
Conducted spurious @ GFSK channel 0 (3 of 3)



CH 0 at Bluetooth mode 2483.5MHz~26000MHzGFSK

Date: 18.JAN.2010 12:42:08

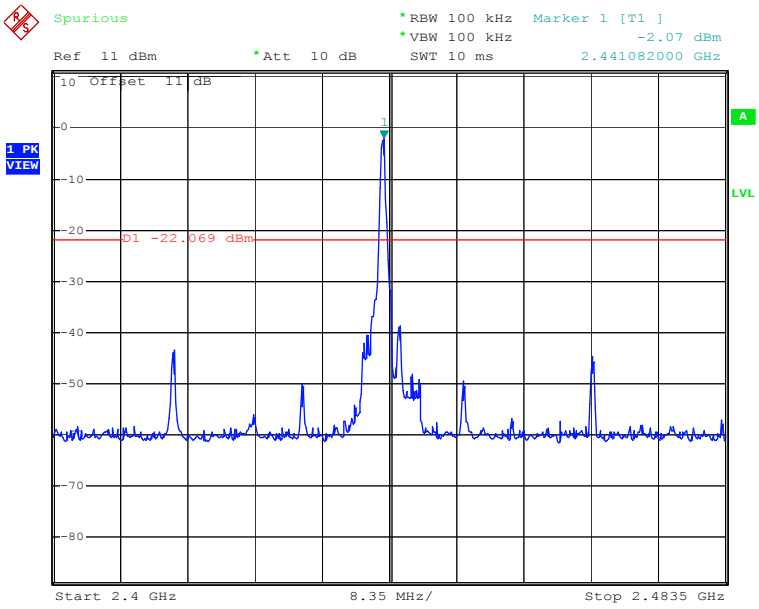
Conducted spurious @ GFSK channel 39 (1 of 3)



CH 0 at Bluetooth mode 30MHz~2400MHzGFSK

Date: 18.JAN.2010 12:43:12

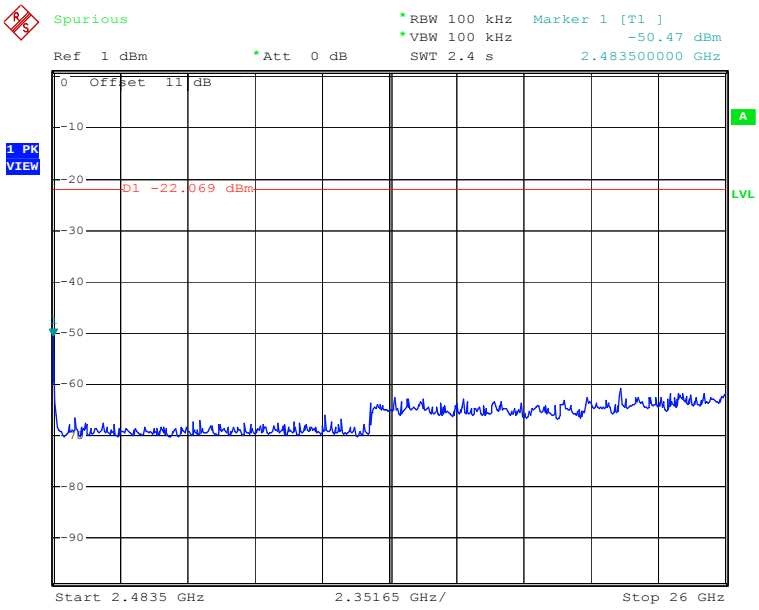
Conducted spurious @ GFSK channel 39 (2 of 3)



CH 0 at Bluetooth mode 2400MHz~2483.5MHzGFSK

Date: 18.JAN.2010 12:42:54

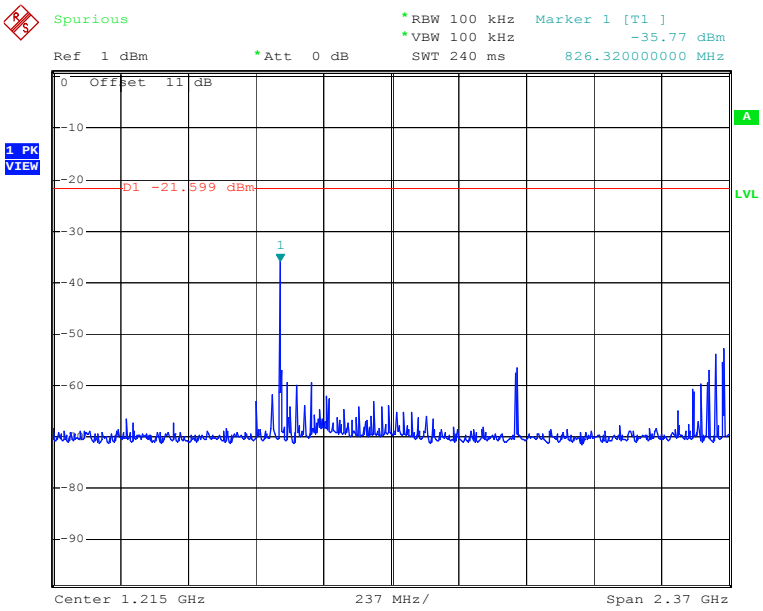
Conducted spurious @ GFSK channel 39 (3 of 3)



CH 0 at Bluetooth mode 2483.5MHz~26000MHzGFSK

Date: 18.JAN.2010 12:43:29

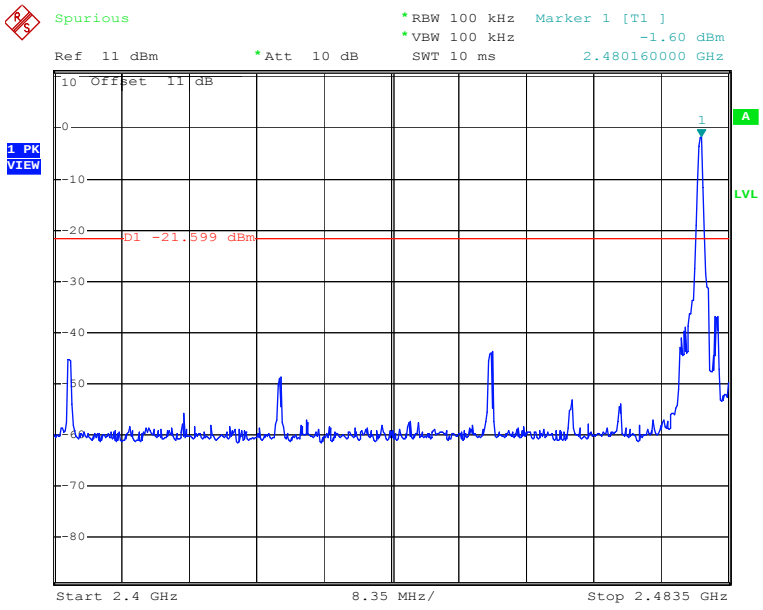
Conducted spurious @ GFSK channel 78 (1 of 3)



CH 39 at Bluetooth mode 30MHz~2400MHzGFSK

Date: 18.JAN.2010 12:44:24

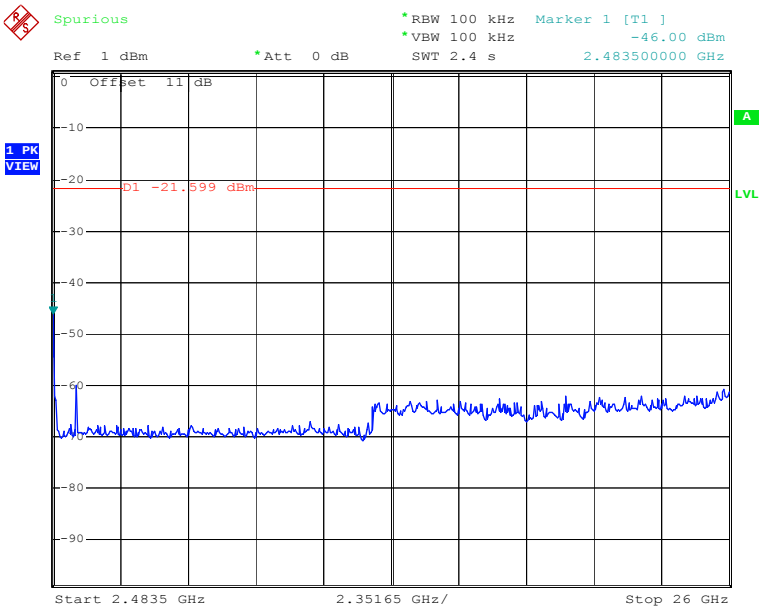
Conducted spurious @ GFSK channel 78 (2 of 3)



CH 39 at Bluetooth mode 2400MHz~2483.5MHzGFSK

Date: 18.JAN.2010 12:44:06

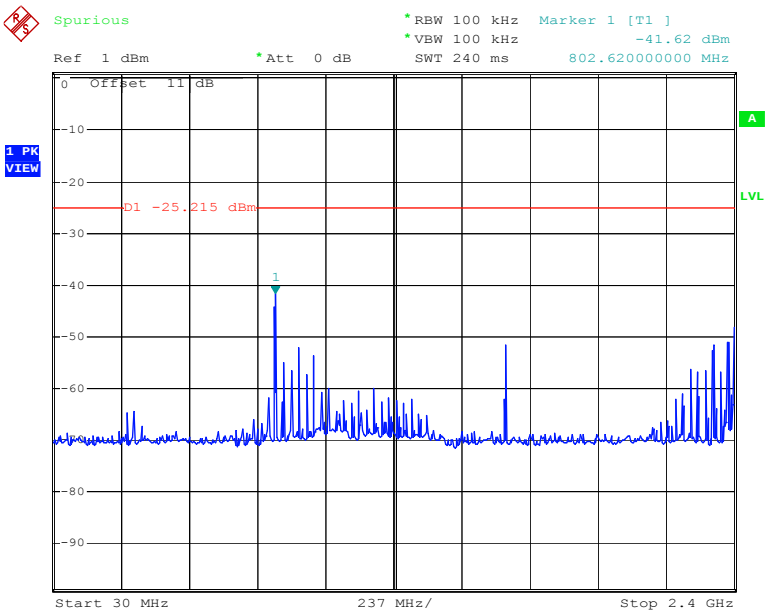
Conducted spurious @ GFSK channel 78 (3 of 3)



CH 39 at Bluetooth mode 2483.5MHz~26000MHzGFSK

Date: 18.JAN.2010 12:44:42

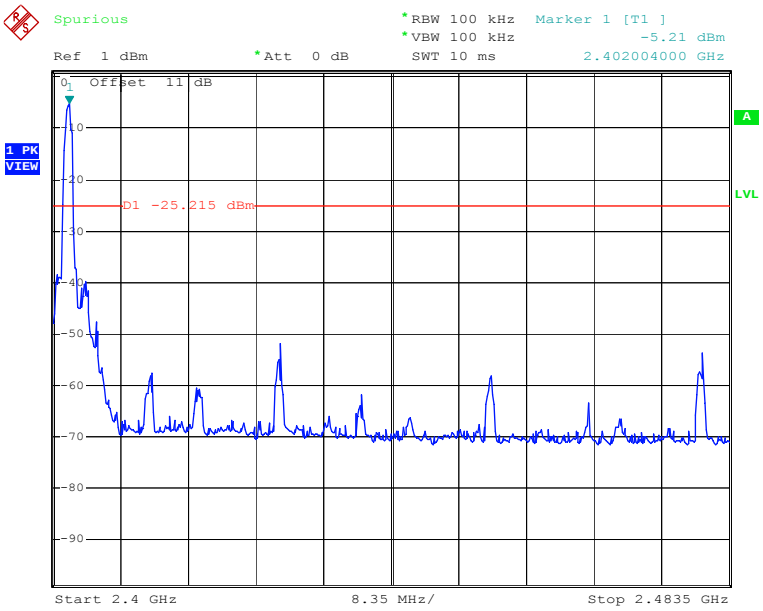
Conducted spurious @ π /4 DPSK channel 0 (1 of 3)



CH 0 at Bluetooth mode 30MHz~2400MHzπ /4 DPSK

Date: 18.JAN.2010 10:11:59

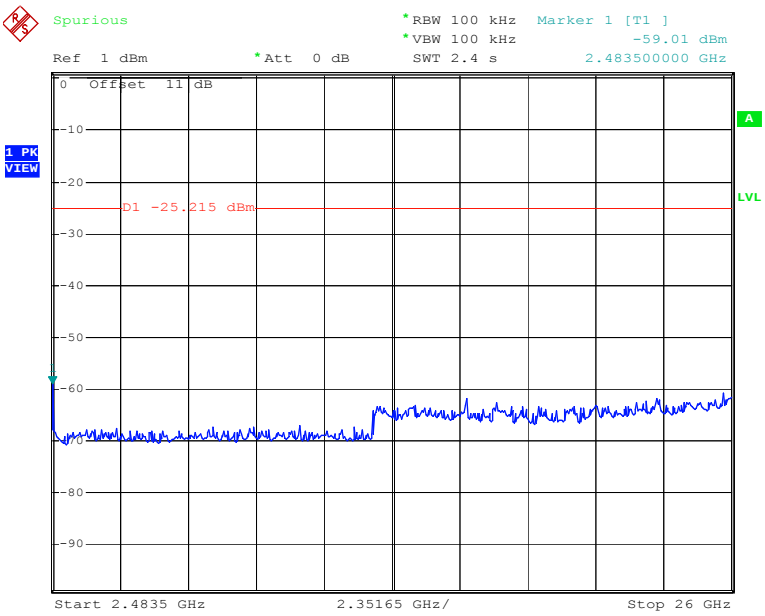
Conducted spurious @ π /4 DPSK channel 0 (2 of 3)



CH 0 at Bluetooth mode 2400MHz~2483.5MHzπ /4 DPSK

Date: 18.JAN.2010 10:11:41

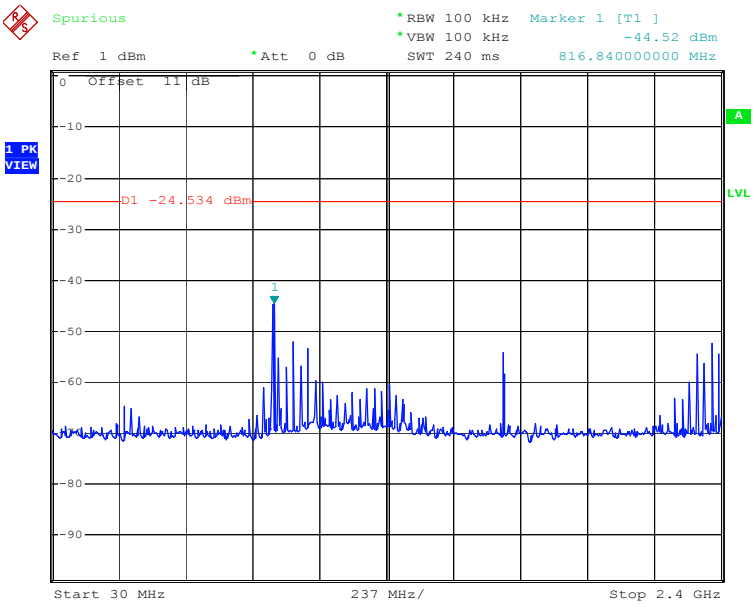
Conducted spurious @ π /4 DPSK channel 0 (3 of 3)



CH 0 at Bluetooth mode 2483.5MHz~26000MHzπ /4 DPSK

Date: 18.JAN.2010 10:12:17

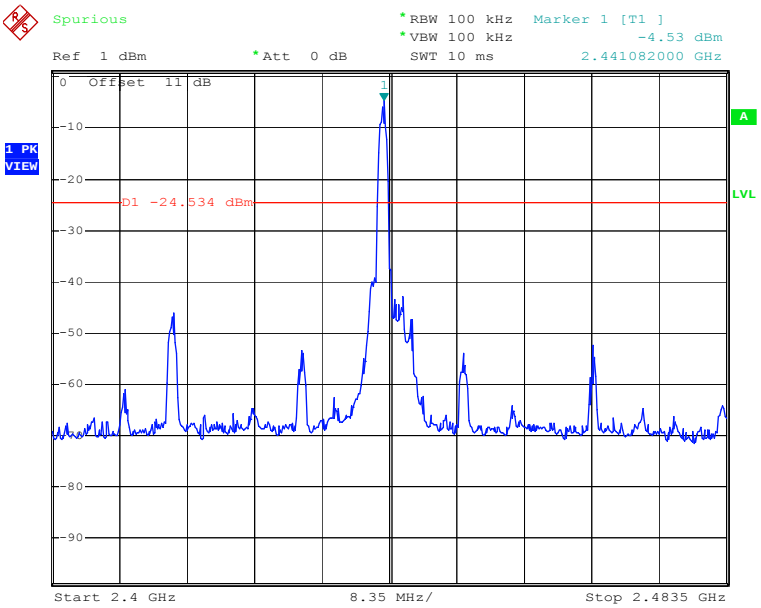
Conducted spurious @ π /4 DPSK channel 39 (1 of 3)



CH 39 at Bluetooth mode 30MHz~2400MHzπ /4 DPSK

Date: 18.JAN.2010 10:14:47

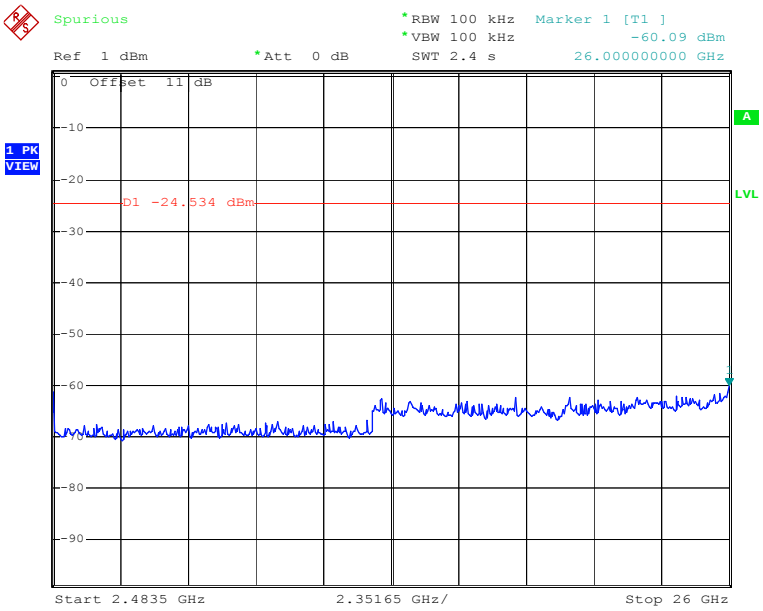
Conducted spurious @ π /4 DPSK channel 39 (2 of 3)



CH 39 at Bluetooth mode 2400MHz~2483.5MHzπ /4 DPSK

Date: 18.JAN.2010 10:14:29

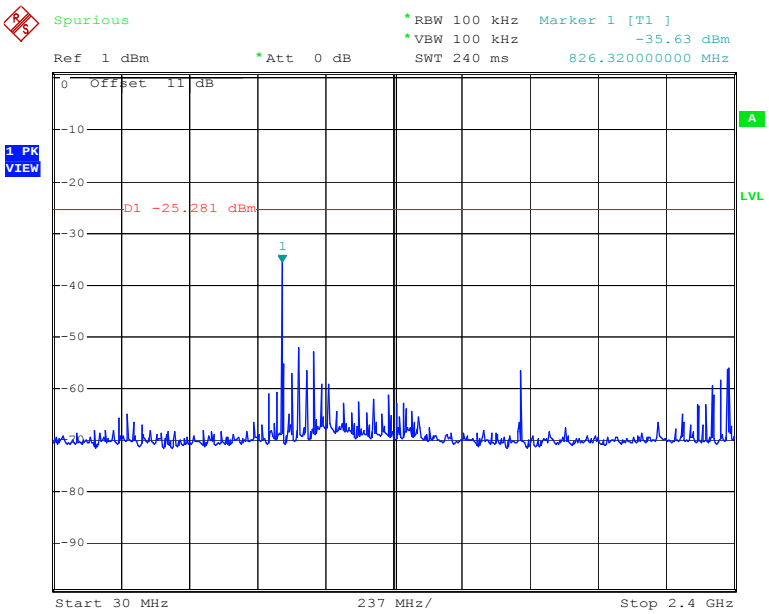
Conducted spurious @ π /4 DPSK channel 39 (3 of 3)



CH 39 at Bluetooth mode 2483.5MHz~26000MHzπ /4 DPSK

Date: 18.JAN.2010 10:15:04

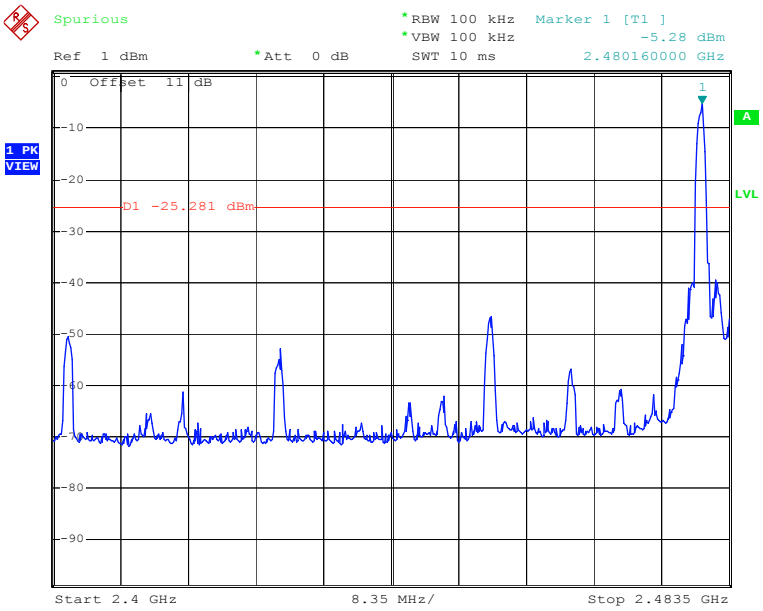
Conducted spurious @ π /4 DPSK channel 78 (1 of 3)



CH 78 at Bluetooth mode 30MHz~2400MHzπ /4 DPSK

Date: 18.JAN.2010 10:16:29

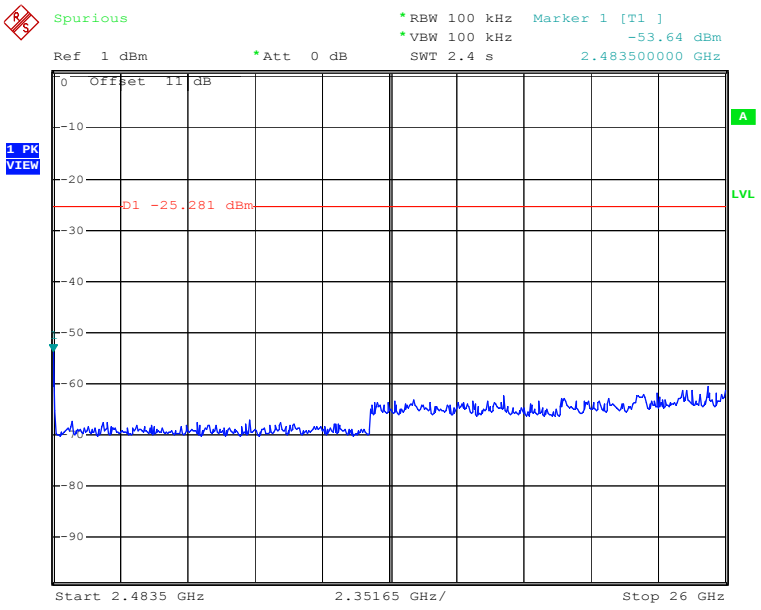
Conducted spurious @ π /4 DPSK channel 78 (2 of 3)



CH 78 at Bluetooth mode 2400MHz~2483.5MHzπ /4 DPSK

Date: 18.JAN.2010 10:16:11

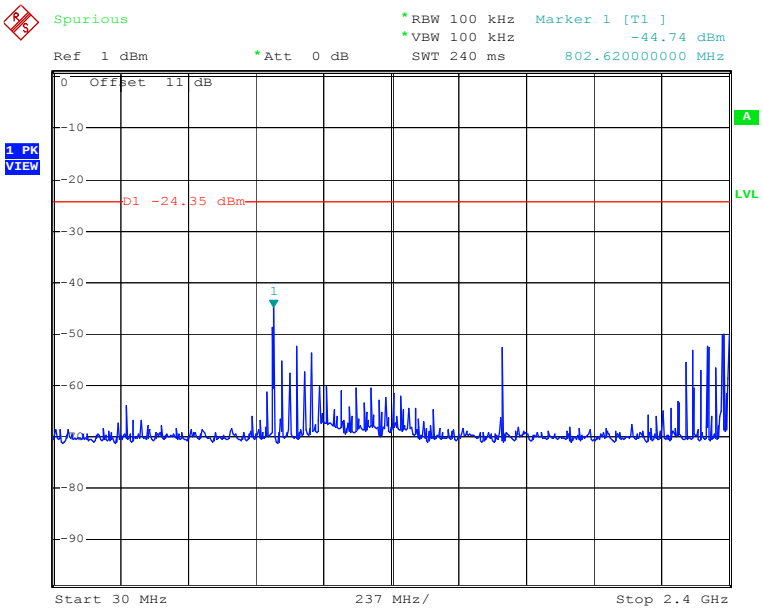
Conducted spurious @ π /4 DPSK channel 78 (3 of 3)



CH 78 at Bluetooth mode 2483.5MHz~26000MHzπ /4 DPSK

Date: 18.JAN.2010 10:16:47

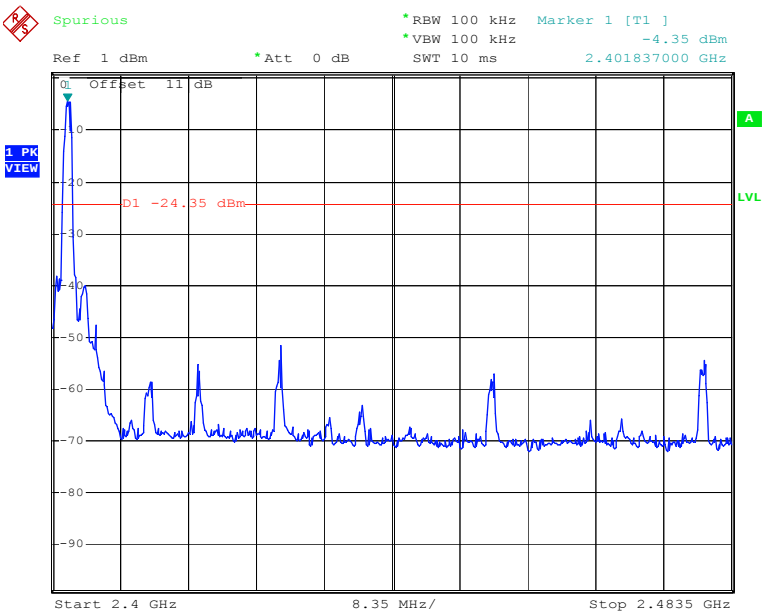
Conducted spurious @ 8DPSK channel 0 (1 of 3)



CH 0 at Bluetooth mode 30MHz~2400MHz8DPSK

Date: 18.JAN.2010 10:20:07

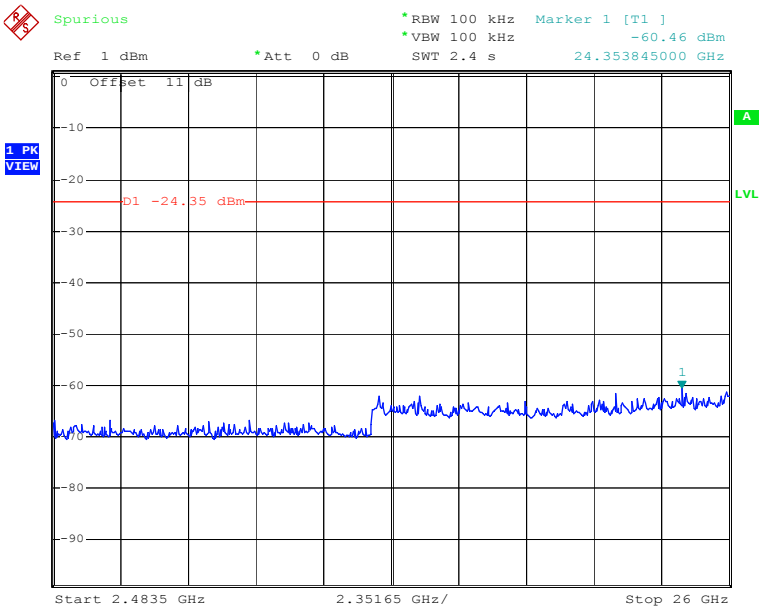
Conducted spurious @ 8DPSK channel 0 (2 of 3)



CH 0 at Bluetooth mode 2400MHz~2483.5MHz8DPSK

Date: 18.JAN.2010 10:19:50

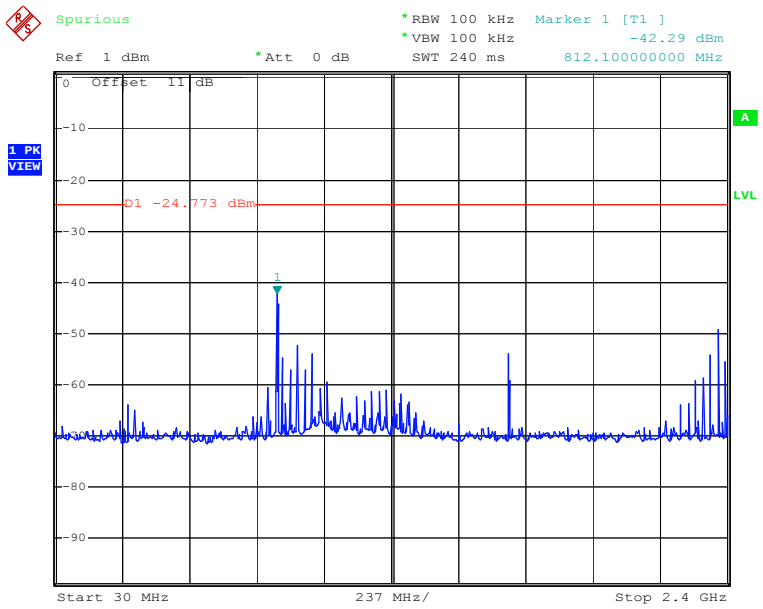
Conducted spurious @ 8DPSK channel 0 (3 of 3)



CH 0 at Bluetooth mode 2483.5MHz~26000MHz8DPSK

Date: 18.JAN.2010 10:20:25

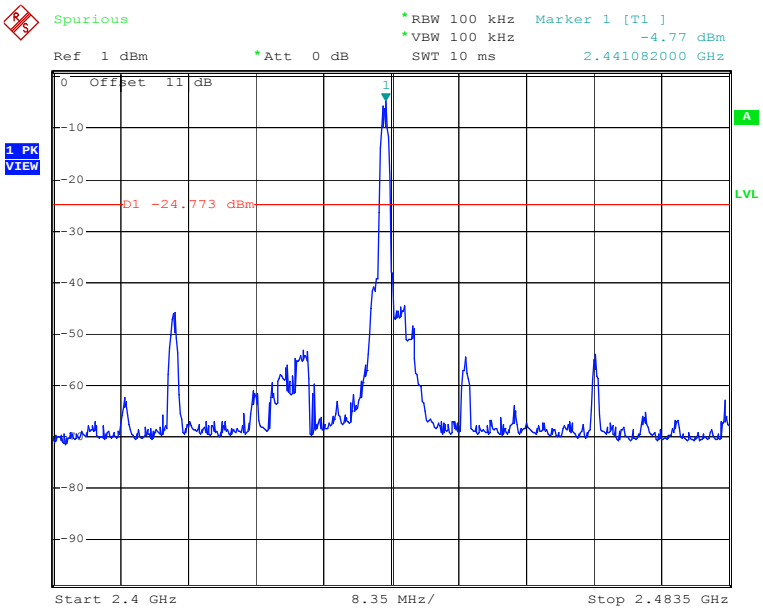
Conducted spurious @ 8DPSK channel 39 (1 of 3)



CH 39 at Bluetooth mode 30MHz~2400MHz8DPSK

Date: 18.JAN.2010 10:22:26

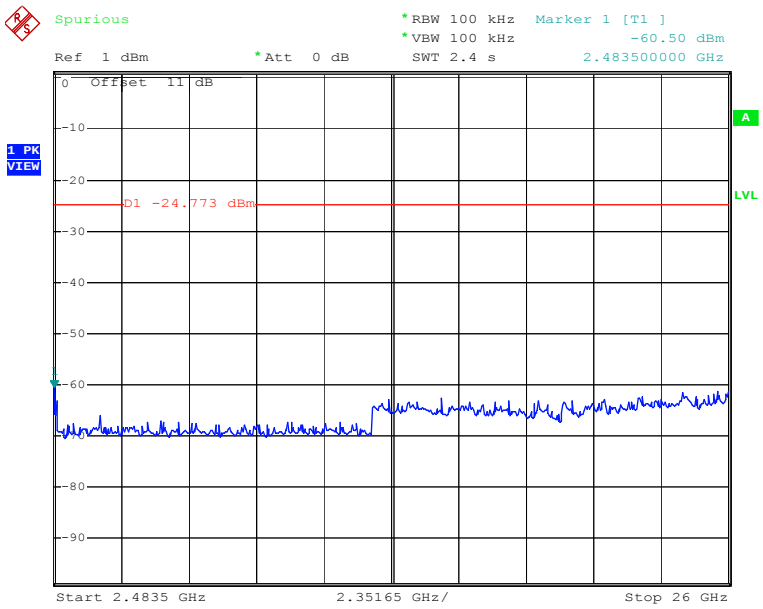
Conducted spurious @ 8DPSK channel 39 (2 of 3)



CH 39 at Bluetooth mode 2400MHz~2483.5MHz8DPSK

Date: 18.JAN.2010 10:22:08

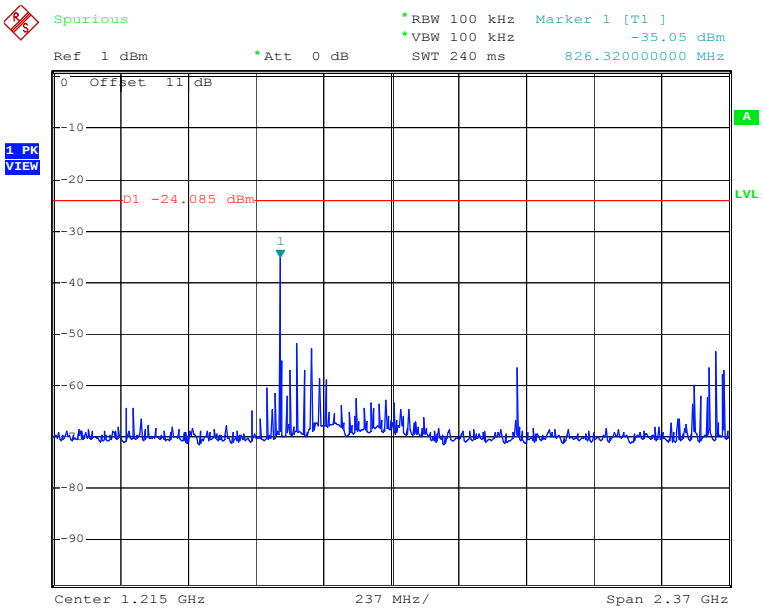
Conducted spurious @ 8DPSK channel 39 (3 of 3)



CH 39 at Bluetooth mode 2483.5MHz~26000MHz8DPSK

Date: 18.JAN.2010 10:22:44

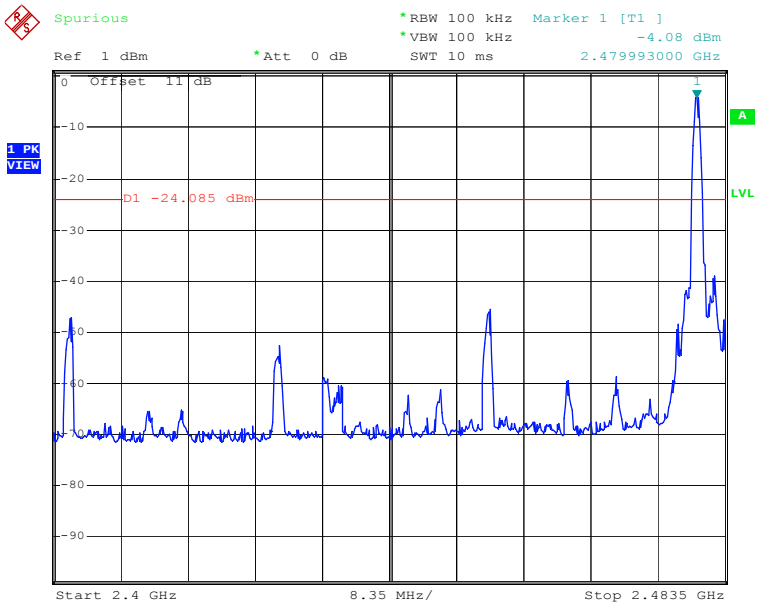
Conducted spurious @ 8DPSK channel 78 (1 of 3)



CH 78 at Bluetooth mode 30MHz~2400MHz8DPSK

Date: 18.JAN.2010 10:24:15

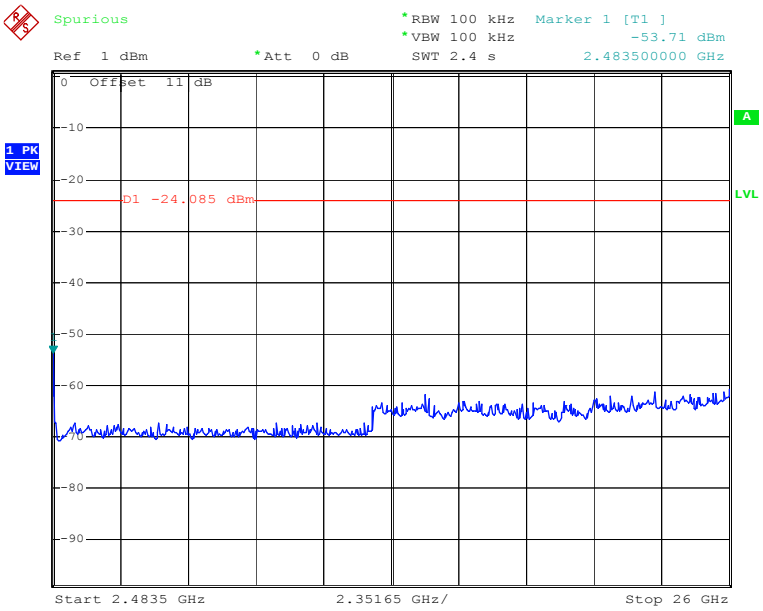
Conducted spurious @ 8DPSK channel 78 (2 of 3)



CH 78 at Bluetooth mode 2400MHz~2483.5MHz8DPSK

Date: 18.JAN.2010 10:23:57

Conducted spurious @ 8DPSK channel 78 (3 of 3)



CH 78 at Bluetooth mode 2483.5MHz~26000MHz8DPSK

Date: 18.JAN.2010 10:24:33

9. Radiated Emission test

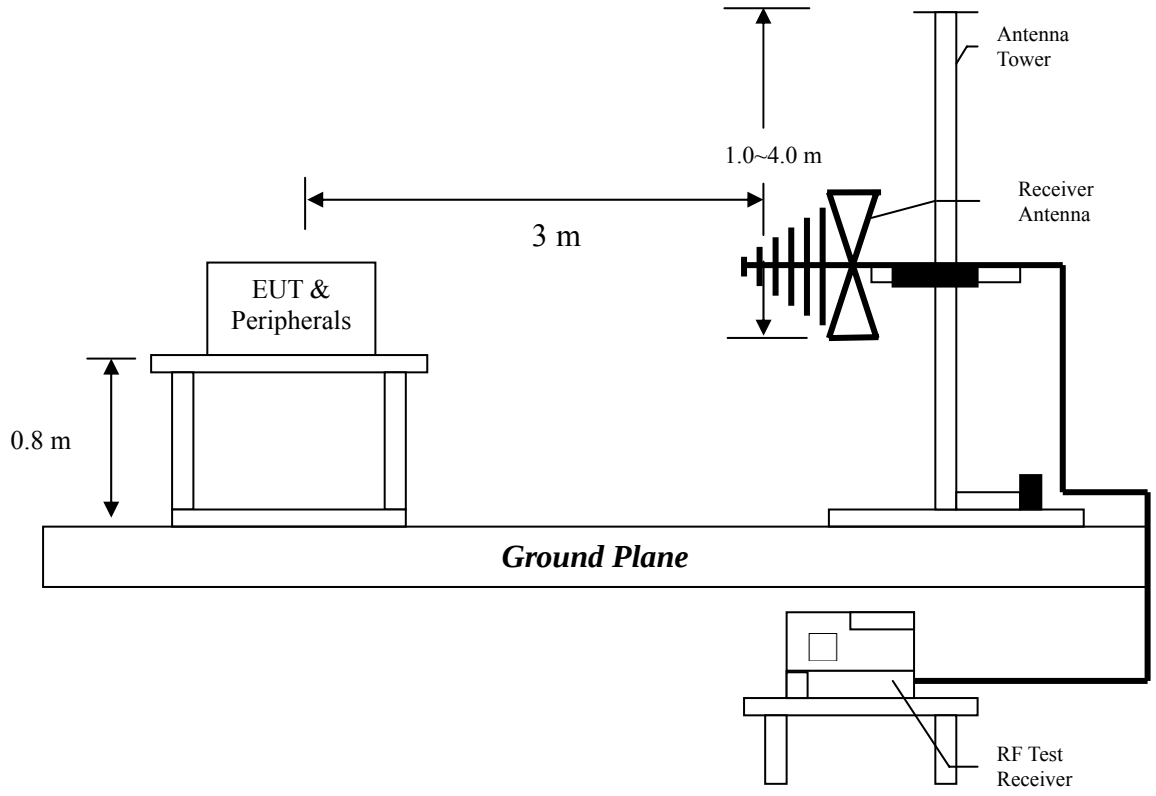
9.1 Operating environment

Temperature:	23	℃
Relative Humidity:	53	%
Atmospheric Pressure:	1023	hPa

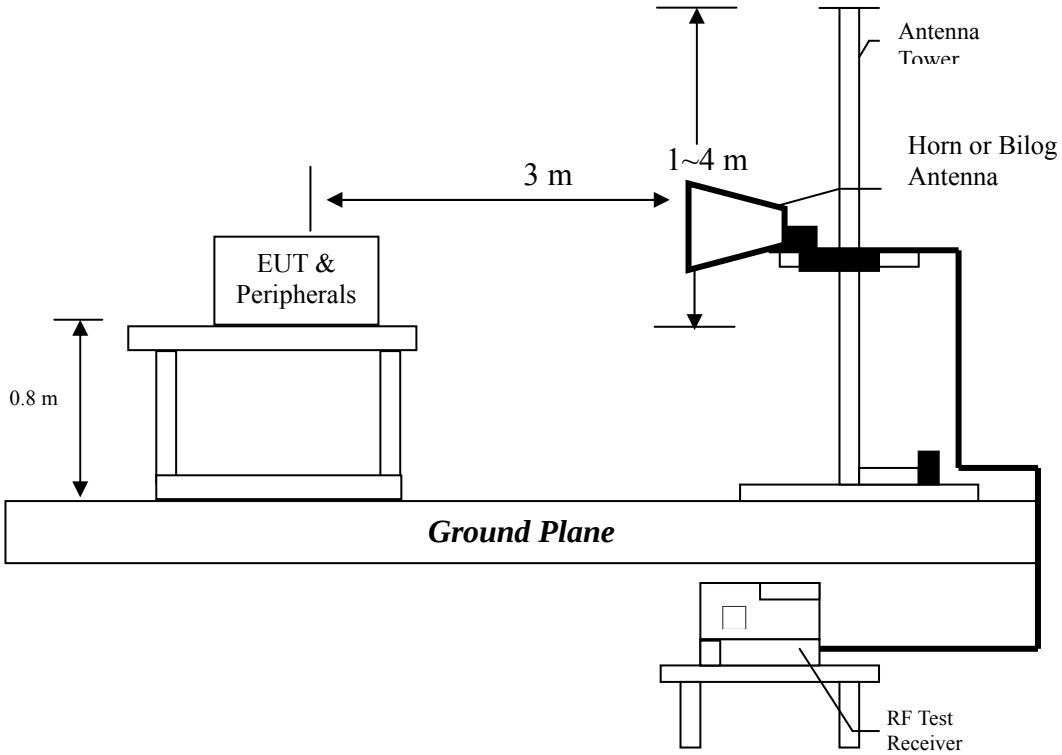
9.2 Test setup & procedure

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.

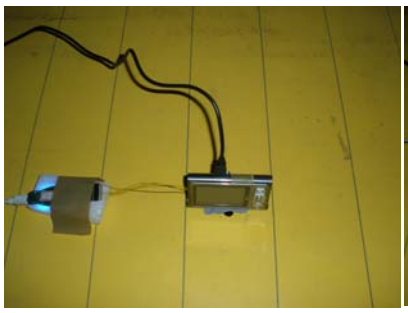


The signal is maximized through rotation and placement in the three orthogonal axes.
Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.
The EUT for testing is arranged on a wooden 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 signal is maximized through rotation and placement in the three orthogonal axes.


x plane


y plane


z plane

After verifying three axes, we found the maximum electromagnetic field was occurred at x-plane configuration. The final test data was executed under this configuration.

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 (dB μ V/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 the closed 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

EUT : T500
Test Condition : Normal operating mode

Antenna Polarization	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
Vertical	363.68	QP	15.06	18.60	33.66	46.00	-12.34
Vertical	416.06	QP	16.47	18.69	35.16	46.00	-10.84
Vertical	467.47	QP	17.68	22.41	40.09	46.00	-5.91
Vertical	546.04	QP	19.46	14.45	33.91	46.00	-12.09
Vertical	597.45	QP	20.71	17.54	38.25	46.00	-7.75
Vertical	649.83	QP	21.53	13.79	35.32	46.00	-10.68
Horizontal	127.97	QP	11.62	26.94	38.55	43.50	-4.95
Horizontal	363.68	QP	15.48	26.60	42.07	46.00	-3.93
Horizontal	416.06	QP	16.81	23.07	39.88	46.00	-6.12
Horizontal	467.47	QP	18.16	25.63	43.79	46.00	-2.21
Horizontal	727.43	QP	22.95	15.35	38.30	46.00	-7.70
Horizontal	753.62	QP	23.02	15.68	38.70	46.00	-7.30

Remark:

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

9.4.2 Measurement results: frequency above 1GHz

The EUT was tested while in a continuous transmit mode and the worst case was found in GFSK mode. The EUT was tuned to a low, middle or high channel.

EUT : T500
Test Condition : GFSK at channel 0

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Duty Cycle Correction Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	4804.00	PK	-0.65	53.63	0.00	52.98	74.00	-21.02
Vertical	4804.00	AV	-0.65	53.63	-40.07	12.91	54.00	-41.09
Horizontal	1716.00	PK	30.57	25.98	0.00	56.55	74.00	-17.45
Horizontal	1716.00	AV	30.57	25.98	-40.07	16.48	54.00	-37.52
Horizontal	2072.00	PK	31.54	27.14	0.00	58.68	74.00	-15.32
Horizontal	2072.00	AV	31.54	27.14	-40.07	18.61	54.00	-35.39
Horizontal	3480.00	PK	-3.32	50.18	0.00	46.86	74.00	-27.14
Horizontal	3480.00	AV	-3.32	50.18	-40.07	6.79	54.00	-47.21
Horizontal	4804.00	PK	-0.65	48.95	0.00	48.30	74.00	-25.70
Horizontal	4804.00	AV	-0.65	48.95	-40.07	8.23	54.00	-45.77

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 : T500
Test Condition : GFSK at channel 39

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Duty Cycle Correction Factor (dB)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
Vertical	4882.00	PK	-0.57	54.15	0.00	53.58	74.00	-20.42
Vertical	4882.00	AV	-0.57	54.15	-40.07	13.51	54.00	-40.49
Horizontal	4882.00	PK	-0.57	50.26	0.00	49.69	74.00	-24.31
Horizontal	4882.00	AV	-0.57	50.26	-40.07	9.62	54.00	-44.38

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 : T500
Test Condition : GFSK at channel 78

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Duty Cycle Correction Factor (dB)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
Vertical	4960.00	PK	-0.45	53.82	0.00	53.37	74.00	-20.63
Vertical	4960.00	AV	-0.45	53.82	-40.07	13.30	54.00	-40.70
Horizontal	3720.00	PK	-2.63	50.31	0.00	47.68	74.00	-26.32
Horizontal	3720.00	AV	-2.63	50.31	-40.07	7.61	54.00	-46.39
Horizontal	4960.00	PK	-0.45	47.61	0.00	47.16	74.00	-26.84
Horizontal	4960.00	AV	-0.45	47.61	-40.07	7.09	54.00	-46.91

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.

Please see the plot below.

10.2 Test Result

Test Mode: GFSK mode

Channel	Measurement Freq. Band (MHz)	Detector	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (lowest)	2310-2390	PK	62.2	74	-11.80
		AV	22.13	54	-31.87
78 (highest)	2483.5-2500	PK	60.88	74	-13.12
		AV	20.81	54	-33.19

Remark: Duty Cycle Correction Factor = -40.07 dB

Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

Test Mode: π /4 DPSK mode

Channel	Measurement Freq. Band (MHz)	Detector	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (lowest)	2310-2390	PK	60.89	74	-13.11
		AV	20.85	54	-33.15
78 (highest)	2483.5-2500	PK	60.62	74	-13.38
		AV	20.58	54	-33.42

Remark: Duty Cycle Correction Factor = -40.04 dB

Please refer Time of Occupancy (dwell time) **test** in clause 6 of this report.

Test Mode: 8DPSK mode

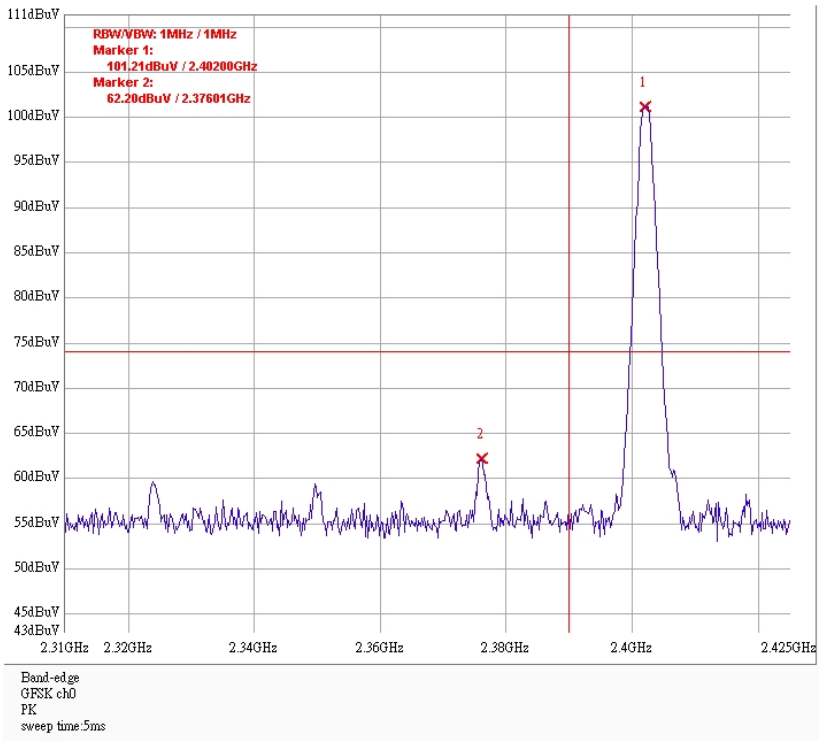
Channel	Measurement Freq. Band (MHz)	Detector	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
0 (lowest)	2310-2390	PK	61.02	74	-12.98
		AV	20.92	54	-33.08
78 (highest)	2483.5-2500	PK	61.25	74	-12.75
		AV	21.15	54	-32.85

Remark: Duty Cycle Correction Factor = -40.10 dB

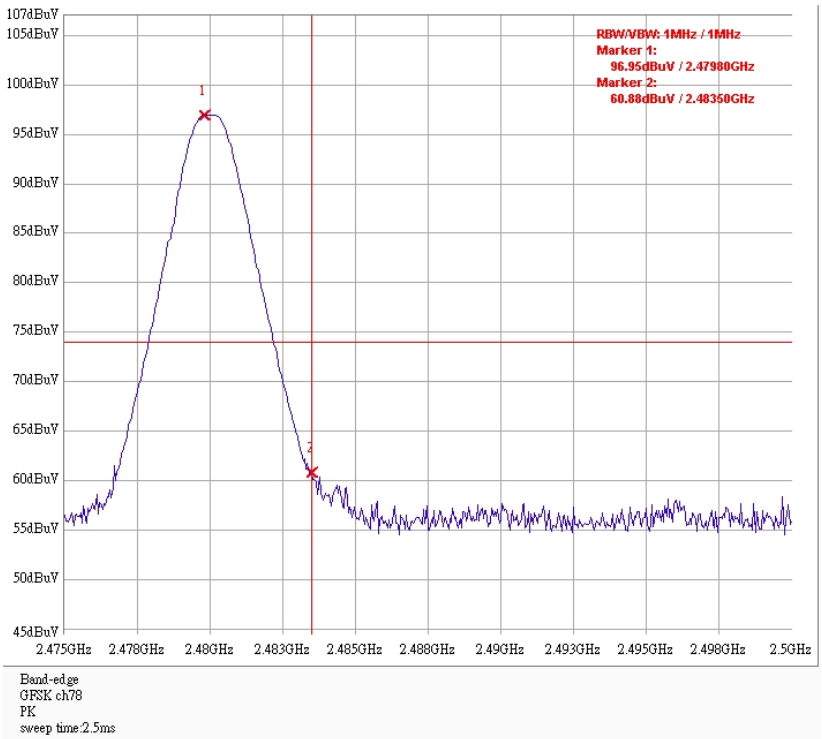
Please refer Time of Occupancy (dwell time) test in clause 6 of this report.

10.2.1 Band edge

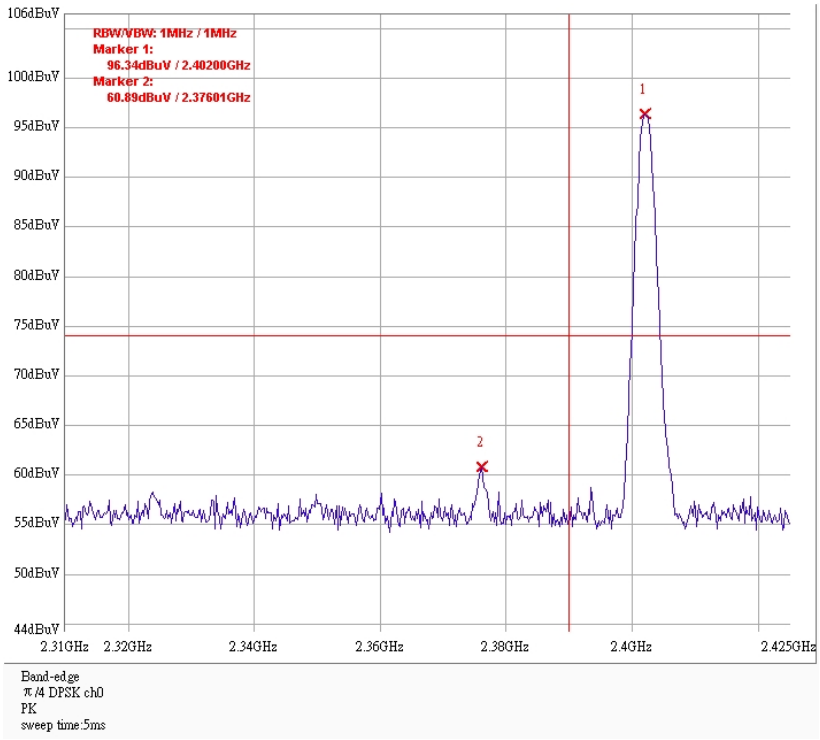
Band edge @ GFSK mode channel 0 PK



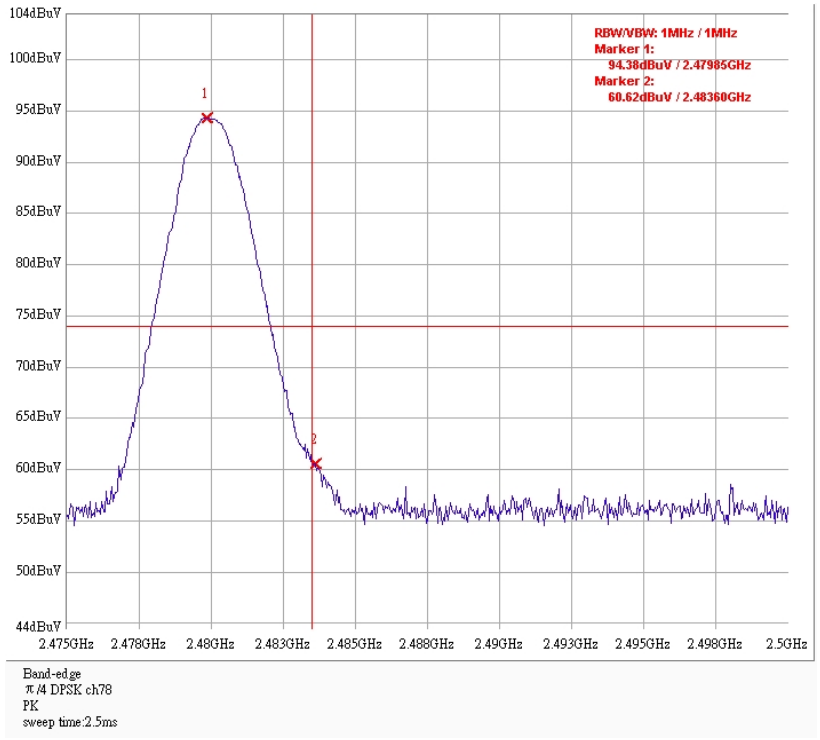
Band edge @ GFSK mode channel 78 PK



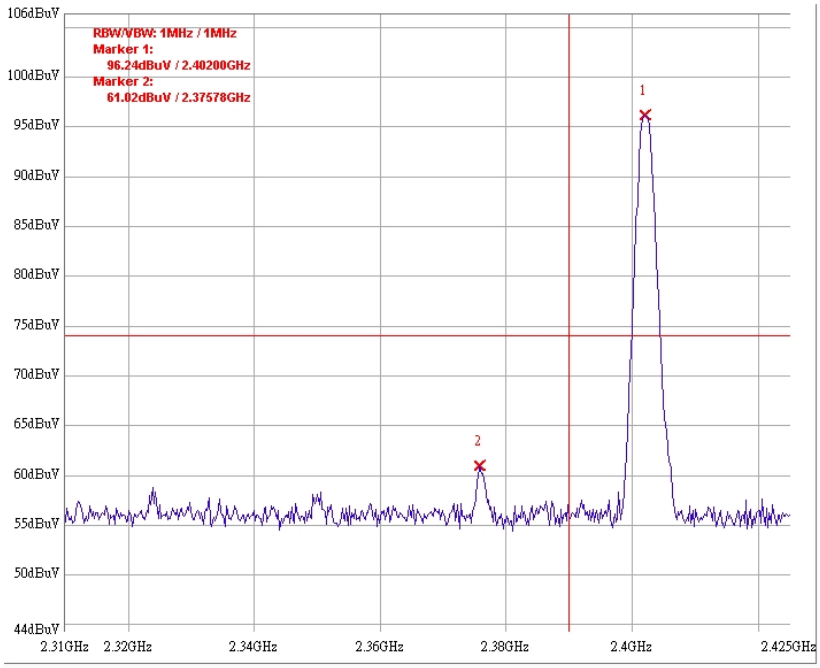
Band edge @ π /4DPSK mode channel 0 PK



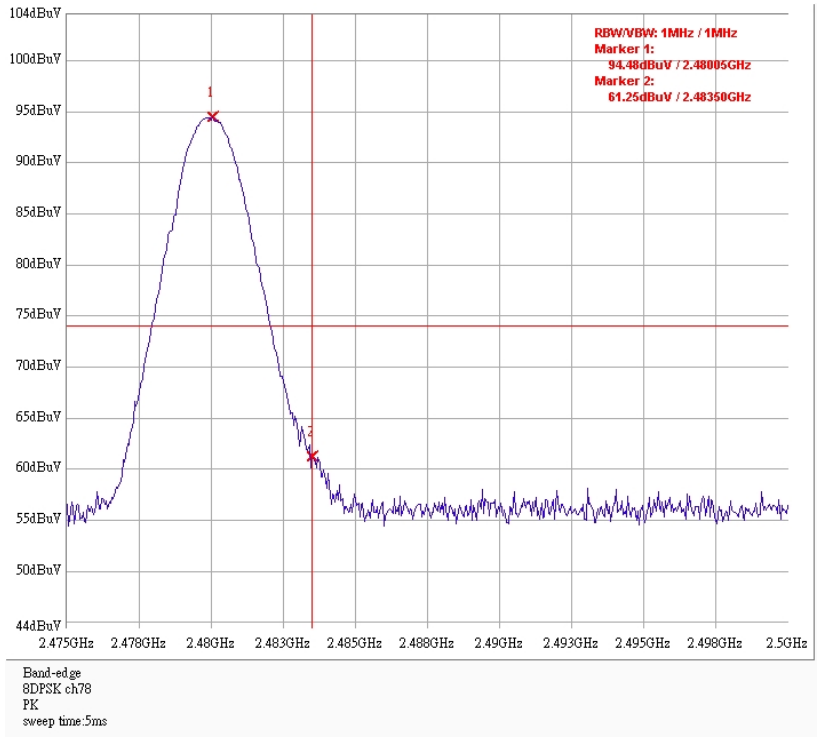
Band edge @ π /4DPSK mode channel 78 PK



Band edge @ 8DPSK mode channel 0 PK



Band edge @ 8DPSK mode channel 78 PK

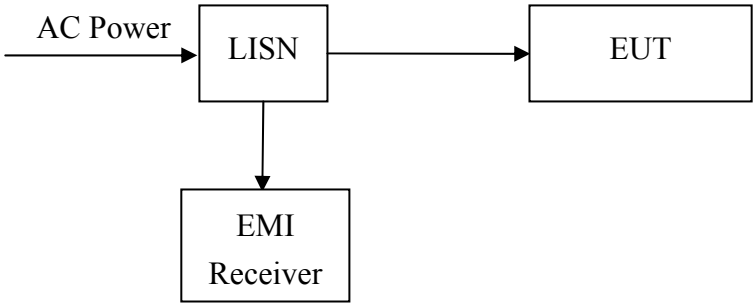


11. Power Line Conducted Emission test §FCC 15.207

11.1 Operating environment

Temperature:	25	℃
Relative Humidity:	60	%
Atmospheric Pressure	1023	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

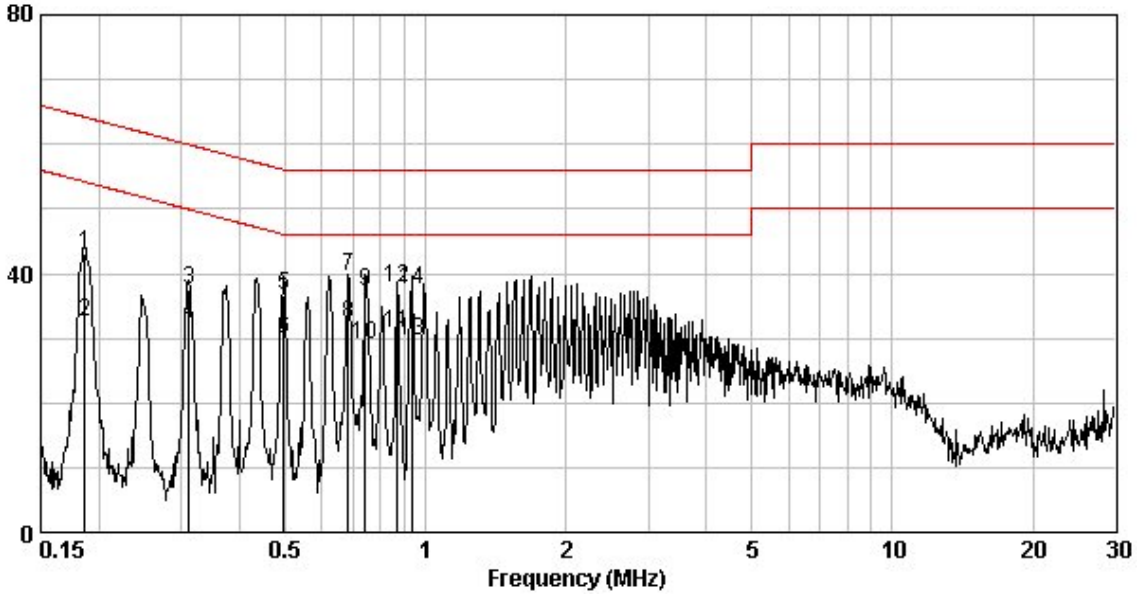
Expanded uncertainty (k=2) of conducted emission measurement is ±2.786 dB.

11.5 Power Line Conducted Emission test data

Phase: Line
Model No.: T500
Operating mode: Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.19	0.81	43.04	64.20	32.55	54.20	-21.16	-21.65
0.31	0.36	37.65	59.93	32.20	49.93	-22.28	-17.73
0.50	0.11	36.65	56.05	29.85	46.05	-19.41	-16.21
0.68	0.11	39.47	56.00	32.28	46.00	-16.53	-13.72
0.74	0.11	37.34	56.00	28.97	46.00	-18.66	-17.03
0.87	0.11	37.92	56.00	30.75	46.00	-18.08	-15.25
0.93	0.11	37.56	56.00	29.58	46.00	-18.44	-16.42

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



Phase: Neutral
Model No.: T500
Operating mode: Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Av
0.19	0.11	40.68	64.24	31.17	54.24	-23.56	-23.07
0.68	0.11	35.77	56.00	29.95	46.00	-20.23	-16.05
0.74	0.11	37.00	56.00	30.36	46.00	-19.00	-15.64
0.87	0.11	30.93	56.00	26.00	46.00	-25.07	-20.00
0.99	0.11	35.89	56.00	27.81	46.00	-20.11	-18.19
1.18	0.11	33.42	56.00	25.26	46.00	-22.58	-20.74

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