TEST REPORT For FCC

Test Report No.	: TK-FR10040
Date of Issue	: 10/26/2010
FCC ID	: O25PZ-100
Description of Product	: FM Transceiver(with Bluetooth)
Model No.	: PZ-100
Applicant	: Unimo Technology Co.,Ltd 626 Dangjeong-Dong Gunpo-S Gyeonggi-Do 435-030 KOREA
Manufacturer	: Unimo Technology Co.,Ltd 626 Dangjeong-Dong Gunpo-S Gyeonggi-Do 435-030 KOREA
Standards	: FCC Part 15.247
Test Date	: 10/13/2010 - 10/26/2010
Test Results	: ☒ PASS ☐ FAIL

The test results relate only to the items tested.

Tested by:
Kyu-Chul Shin
Test Engineer
Date:10/26/2010

Reviewed by:
KT Kang
Technical Manager
Date: 10/26/2010

THRU-KES CO.,LTD.
477-6, Hager-Ri, Yoju-Up, Yoju-Gun Kyunggi-Do,469-803, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

TABLE OF CONTENTS

1.0 General Product Description

Equipment model name	: FM Handheld Transceiver(with Bluetooth)
Serial number	: Prototype
EUT condition	: Pre-production, not damaged
Antenna type	: Chip antenna Gain 2.53dBi
Frequency Range	: 2402 ~ 2480 MHz(Bluetooth)
RF output power	: 0.09 dBm Peak Conducted (GFSK)
Number of channels	: 79(Bluetooth)
Type of Modulation(Data Rate)	: GFSK(1Mbps)
Power Source	: Li-ion Battery (DC 7.5V)

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz)	2402	2441	2480

1.2 Tested Mode

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

- Following channel(s) was (were) selected for the final test as listed below.

Tested Ch	Modulation Technology	Modulation Type	Packet Type
Low,Mid, High	FHSS	GFSK	DH5

1.3 Model Differences

Not applicable

1.4 Device Modifications

The following modifications were necessary for compliance:
Not applicable

1.5 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC
EUT	Unimo Technology Co., Ltd.	PZ-100	-	-
PC	D E L L I N C .	DCSM	DP3L5BX	FCC / CE
Monitor	Samsung Electronics Co., Ltd.	CX152S-ANB2	N231H4LT405215	-
Keyboard	D E L L I N C	SK-8115	-	FCC / CE
Mouse	D E L L I N C	OD1161	3 4 9 0 1 1 4 0 5	-

1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.7 Test Facility

The measurement facility is located at 477-6, Hager-Ri, Yoju-Up, Yoju-Gun Kyunggi-Do,469-803, Korea. Tel: +82-31-883-5092/Fax: +82-31-883-5169. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.8 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	**FCC**	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	**KCC**	EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site)	KR100
Canada	**IC**	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1

2.0 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	> 25 kHz	Conducted	C
15.247(a)	Number of Hopping Frequencies	> 15 hops		C
15.247(a)	20 dB Bandwidth	-		C
15.247	Dwell Time	< 0.4 seconds		C
15.247(b)	Transmitter Output Power	< 125mW		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.209	Field Strength of Harmonics	< 54 dBuV (at 3m)	Radiated	C
15.207	AC Conducted Emissions	EN 55022	Line Conducted	NA

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:
- FCC Part 15.247, ANSI C63.4-2003

2.1 Technical Characteristic Test

2.1.1 Carrier Frequency Separation

Test Location
RF Test Room

Test Procedures

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.
After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:
Span = 3 MHz (wide enough to capture the peaks of two adjacent channels)
RBW = 30 kHz (≥ 1% of the span) Sweep = auto
VBW = 30 kHz (≥ RBW) Detector function = peak
Trace = max hold

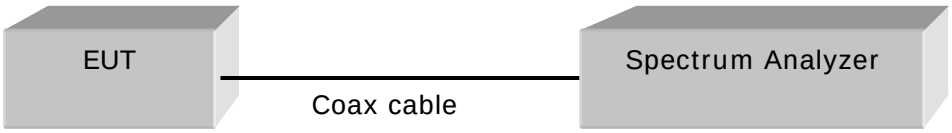


Figure 1 : Measurement setup for the carrier frequency seperation

Limit

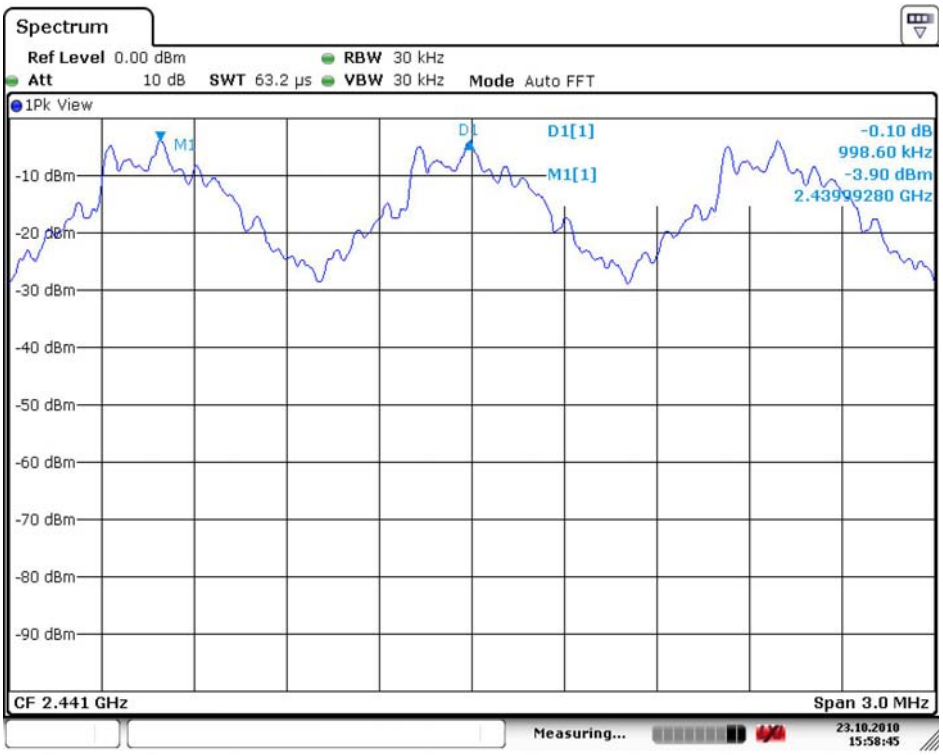
The EUT shall have hopping channel carrier frequencies separated minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Results

Channel	Adjacent Hopping Channel Separation (kHz)	Minimum Bandwidth (kHz)	Result
2441MHz	0.998	25	Complies

See next pages for actual measured spectrum plots.

Carrier Frequency Separation



2.1.2 Number of Hopping Frequencies

Test Location
RF Test Room

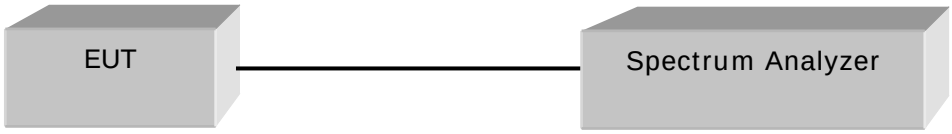
Test Procedures

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Frequency range 1:Start = 2389.5 MHz, Stop = 2439.5 MHz
2:Start = 2439.5 MHz, Stop = 2489.5 MHz

Span = 50 MHz
RBW = 300 kHz (≥ 1% of the span) Sweep = auto
VBW = 300 kHz (≥ RBW) Detector function = peak
Trace = max hold



Limit

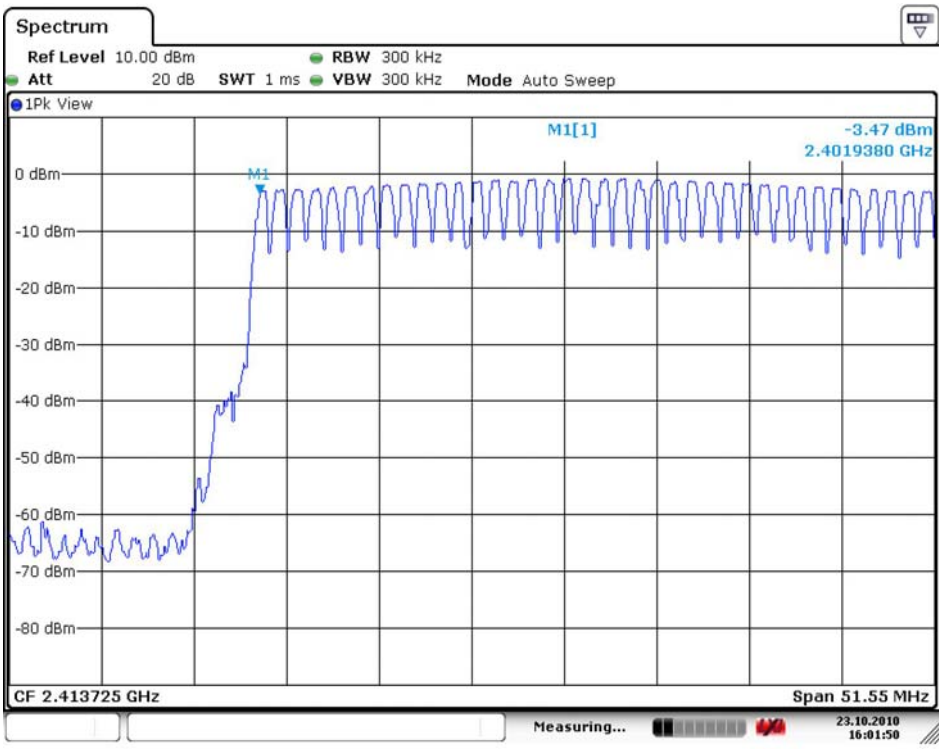
The EUT in the 2400-2483.5 MHz band shall use at least 15 channels.

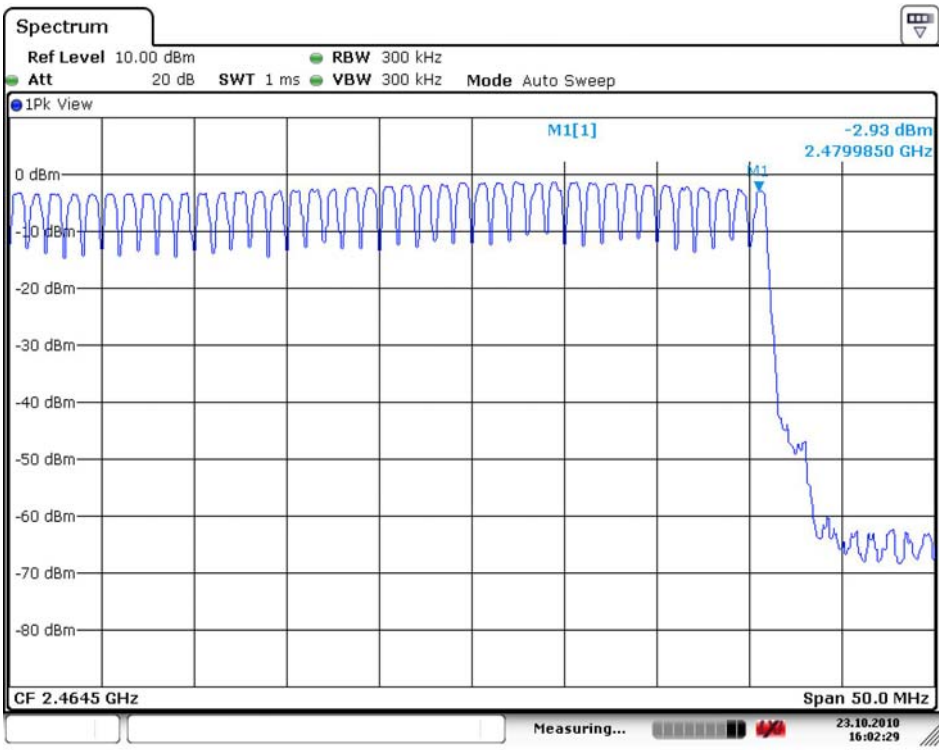
Test Results

Total number of Hopping Channels	Result
79	Complies

See next pages for actual measured spectrum plots.

Number of Hopping Frequencies





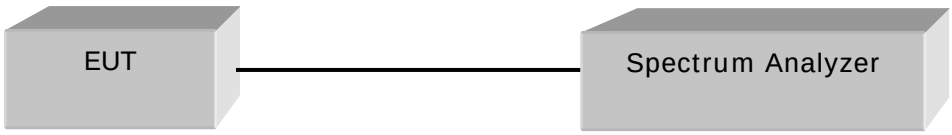
2.1.3 20 dB bandwidth

Test Location
RF Test Room

Test Procedures

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.
After the trace being stable, Use the marker-to peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:
Center frequency = the highest, middle and the lowest channels
Span = 2 MHz (approximately 2 or 3 times of the 20 dB bandwidth)
RBW = 30 kHz (≥ 1% of the span) Sweep = auto
VBW = 30 kHz (≥ RBW) Detector function = peak
Trace = max hold

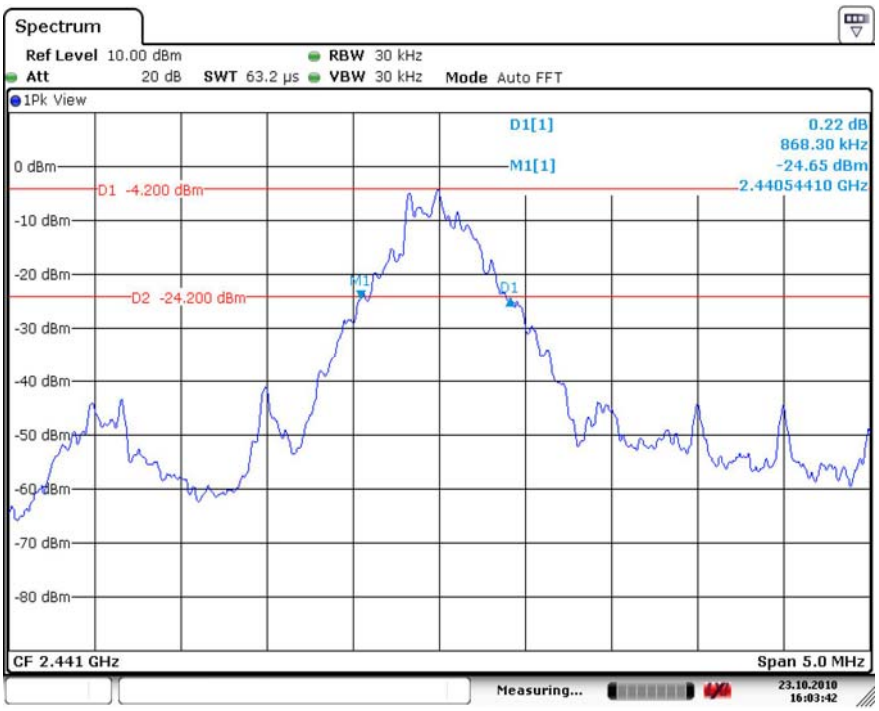


Test Results

Frequency (MHz)	Channel Number.	Measured Bandwidth (MHz)	Result
2441	39	0.868	Complies

See next pages for actual measured spectrum plots.(worst case)

20 dB Bandwidth



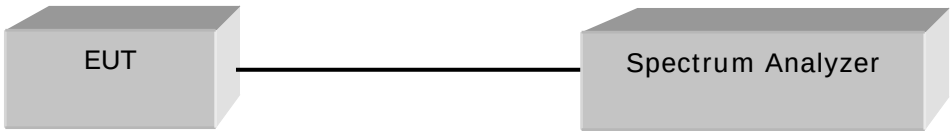
2.1.4 Time of Occupancy (Dwell Time)

Test Location
RF Test Room

Test Procedures

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

The spectrum analyzer is set to:
Center frequency = the highest, middle, and the lowest channels
Span = zero
RBW = 1 MHz
VBW = 1 MHz (≥ RBW)
Trace = max hold
Detector function = peak
Sweep = as necessary to capture the entire dwell time per hopping channel



Limit

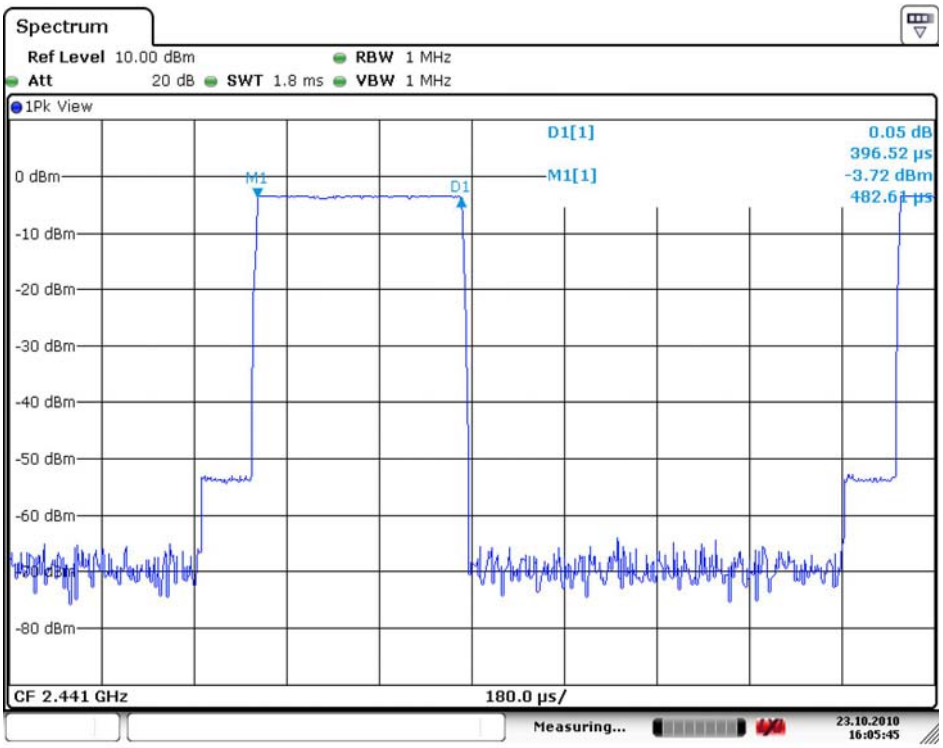
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Results

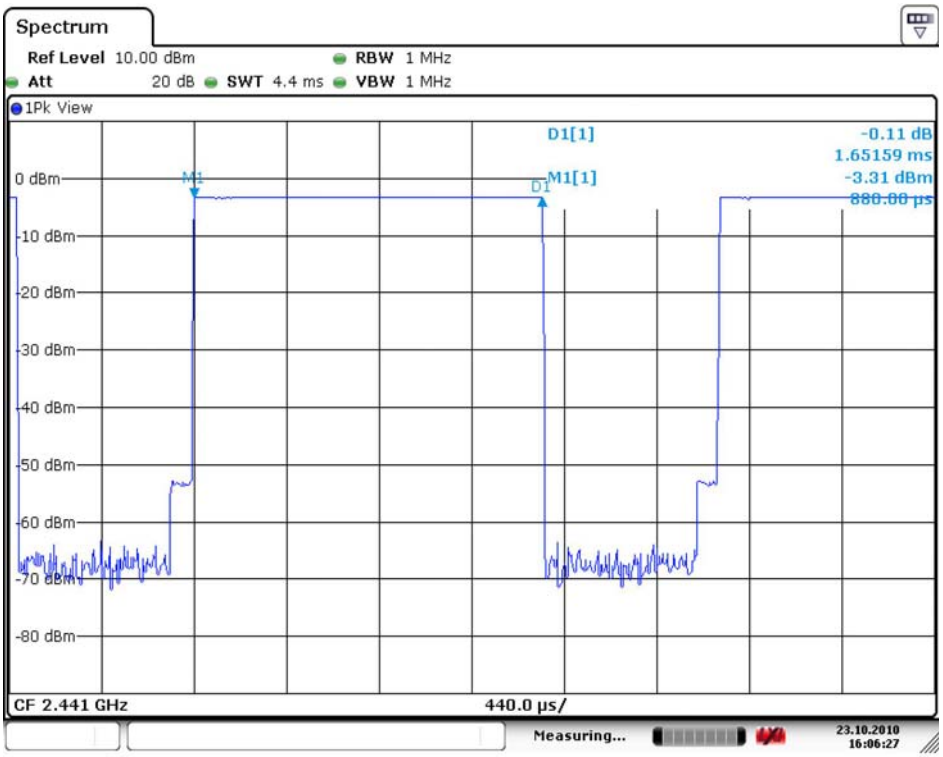
Channel Number	Channel Frequency (MHz)	Packet Type	Test Results	
			Dwell Time (ms)	Result
39	2441	DH 1	**126.76**	Complies
		DH 3	**265.91**	Complies
		DH 5	**306.69**	Complies

See next pages for actual measured spectrum plots.(Worst case)

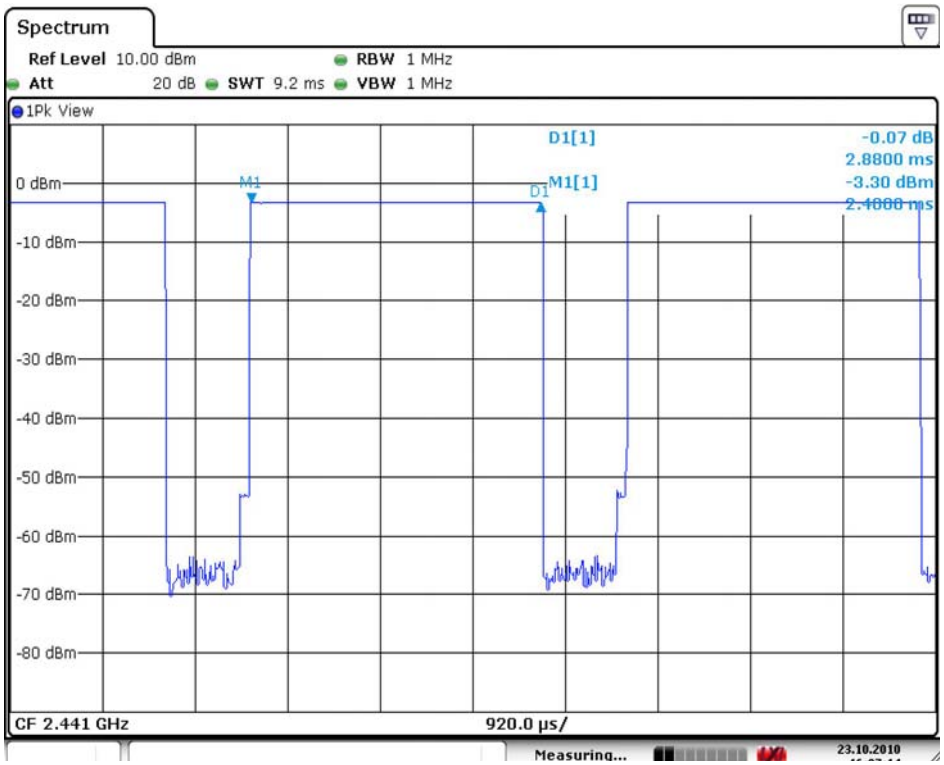
Time of Occupancy for PACKET Type DH 1(GFSK)



Time of Occupancy for PACKET Type DH 3(GFSK)



Time of Occupancy for PACKET Type DH 5(GFSK)



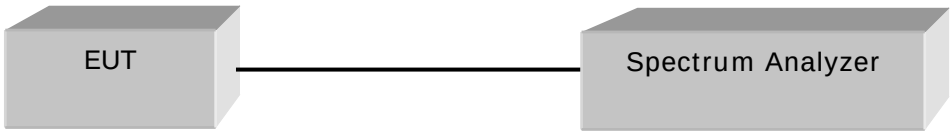
2.1.5 Maximum peak Conducted Output Power

Test Location
RF Test Room

Test Procedures

The maximum peak conducted output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:
Center frequency = the highest, middle, and the lowest channels
Span = 5 MHz (approximately 5 times of the 20 dB bandwidth)
RBW = 1 MHz (greater than the 20 dB bandwidth of the emission being measured)
VBW = 1 MHz (≥ RBW) Detector function = peak
Trace = max hold Sweep = auto



Limit

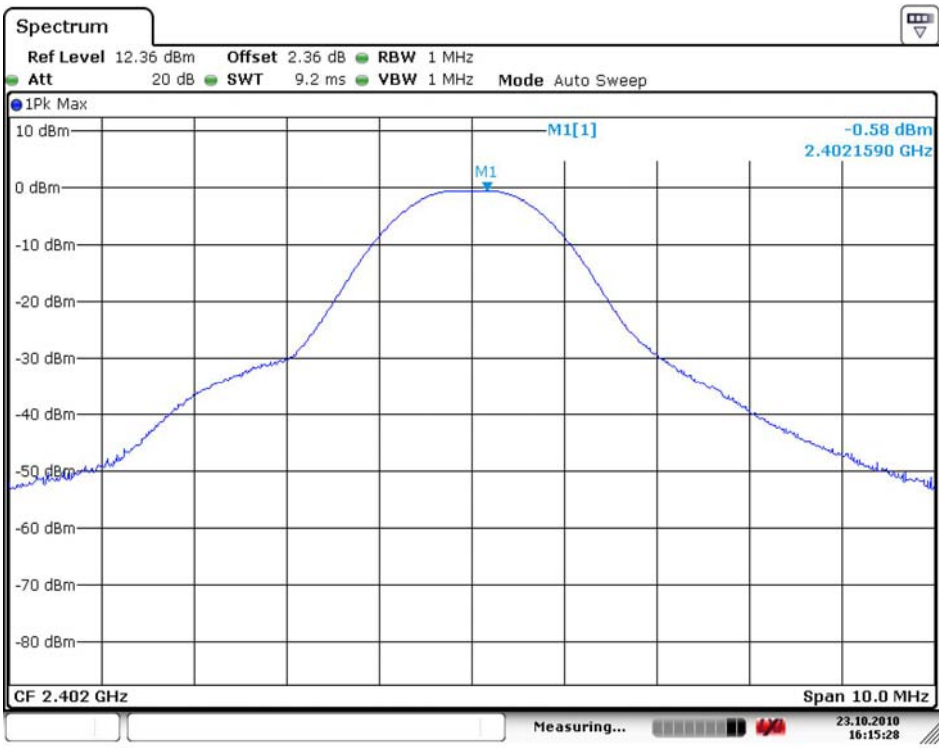
< 1 W

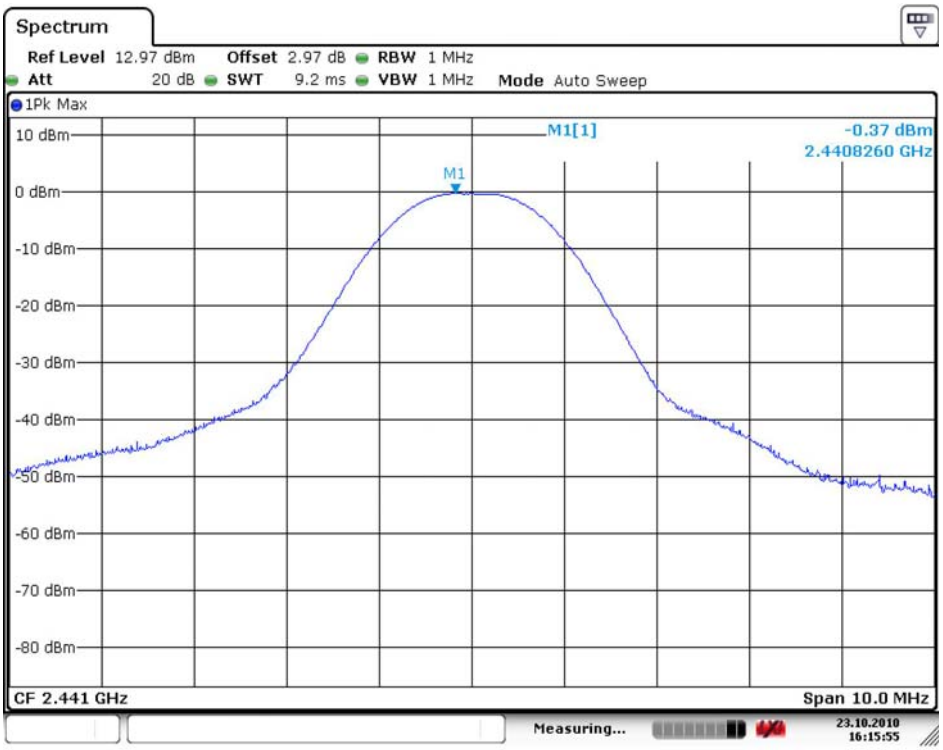
Test Results

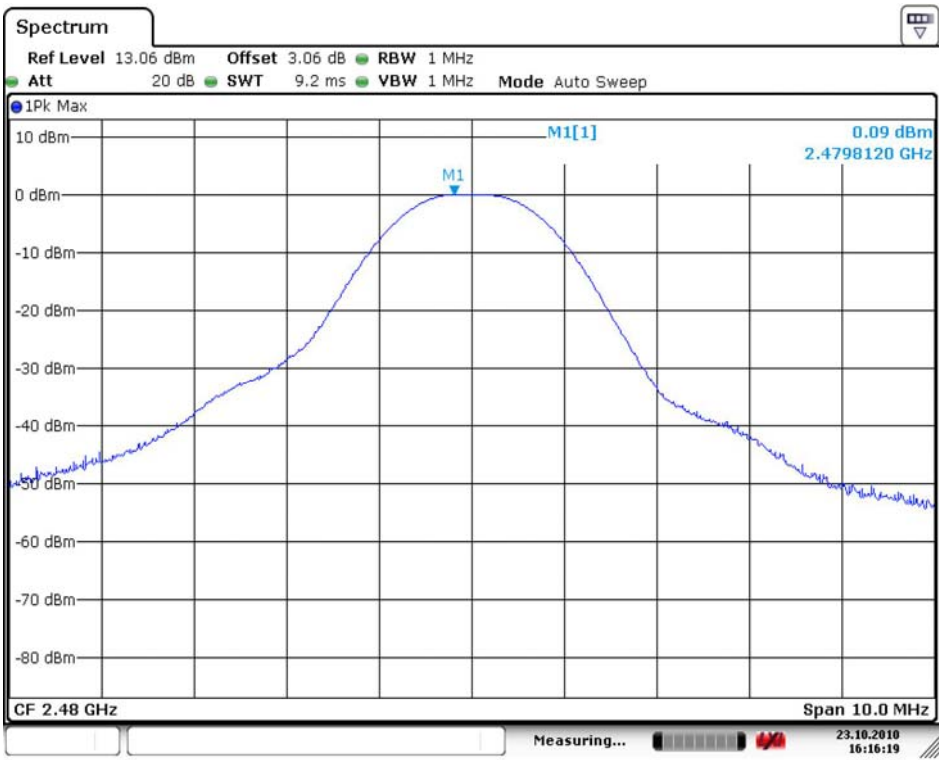
Frequency (MHz)	Channel No.	Peak output power(dBm)	Peak output power(mW)	Result
2402	0	-0.58	0.87	Complies
2441	39	-0.37	0.92	Complies
2480	78	0.09	1.02	Complies

See next pages for actual measured spectrum plots.

Maximum peak Conducted Output Power - GFSK







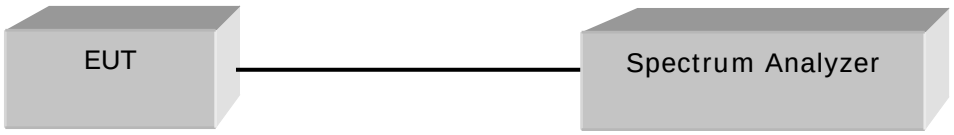
2.1.6 Band-edge

Test Location
RF Test Room

Test Procedures

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:
Center frequency = the highest, middle, and the lowest channels
RBW = 100 kHz
VBW = 100 kHz (≥ RBW)
Span = 100 MHz
Detector function = peak
Trace = max hold
Sweep = auto



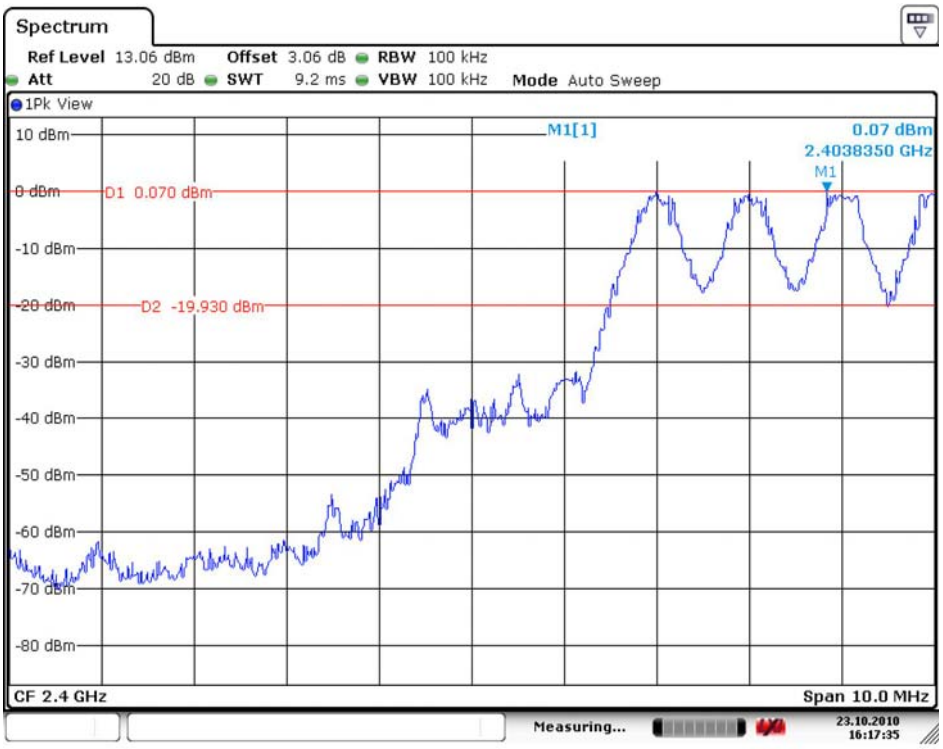
Limit

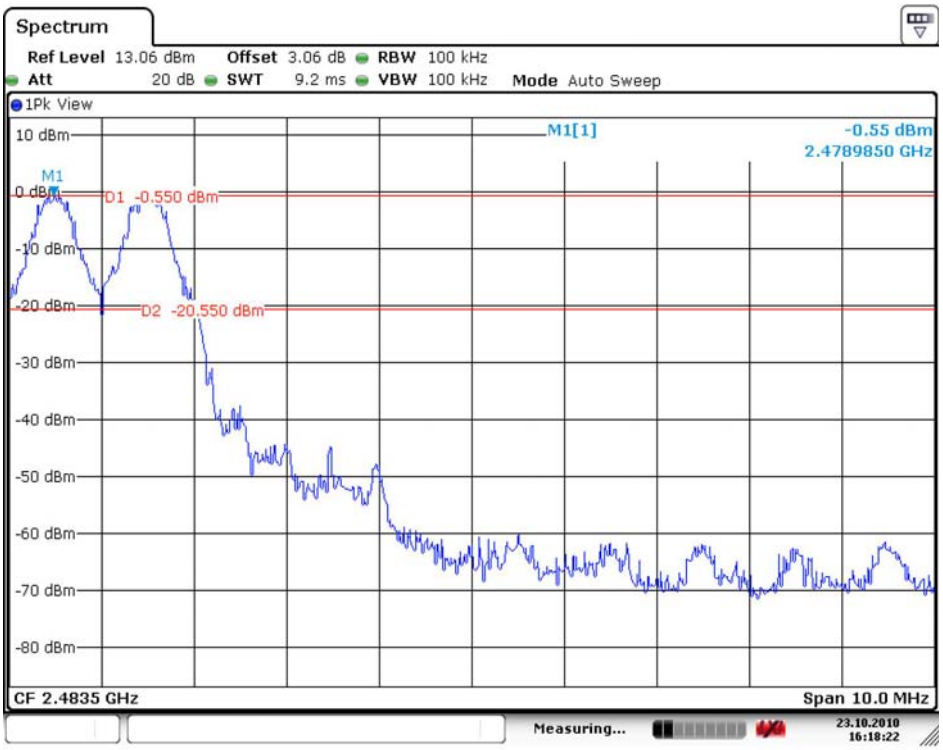
> 20 dBc

Test Results

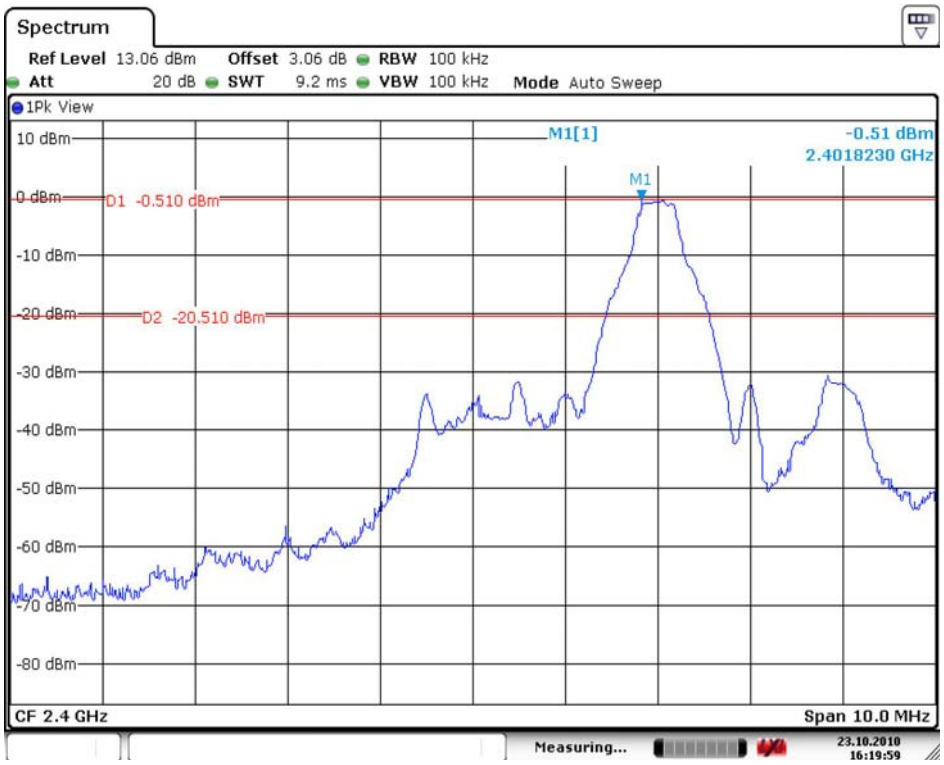
All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest inband spectral density.
Therefore the applying equipment meets the requirement.
See next pages for actual measured spectrum plots.

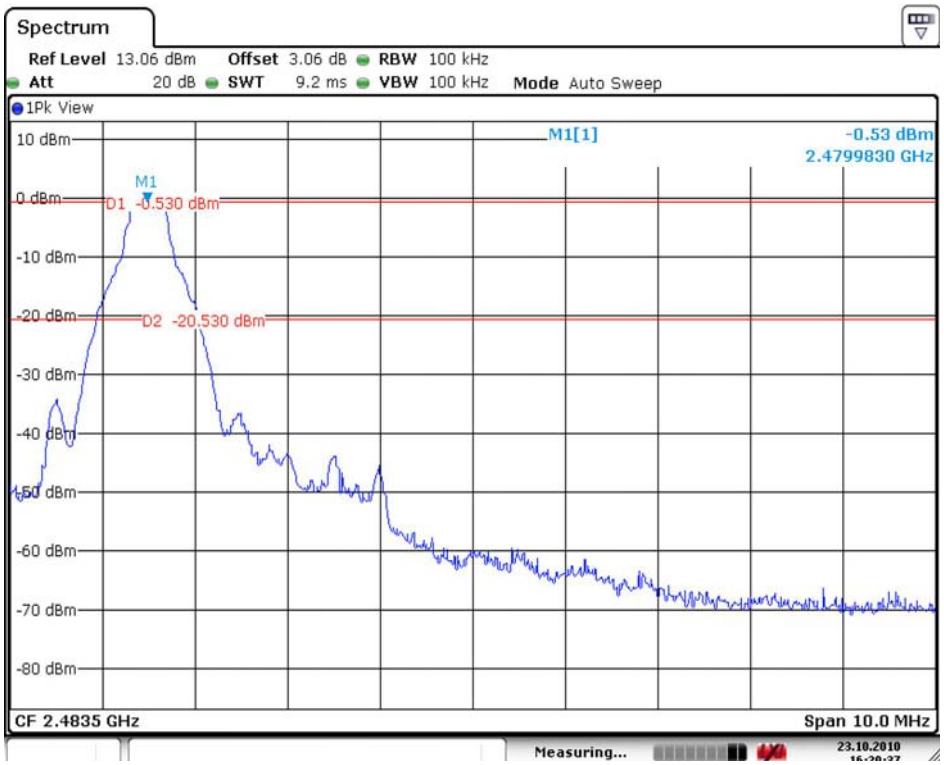
Band – edge (With Hopping) - GFSK



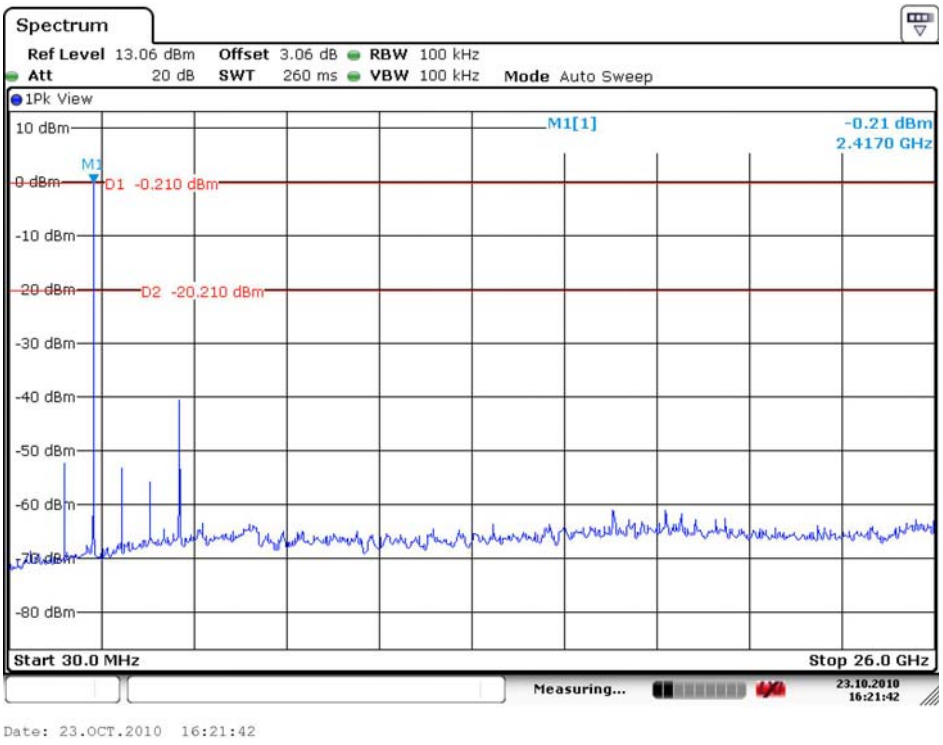


Band – edge (Without Hopping) - GFSK

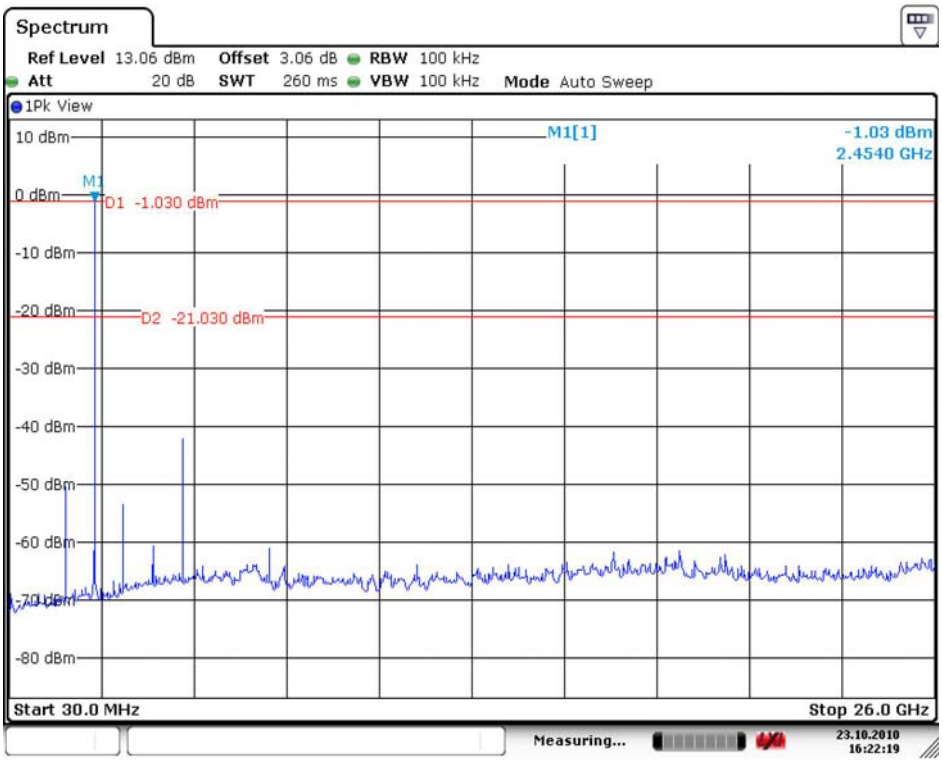




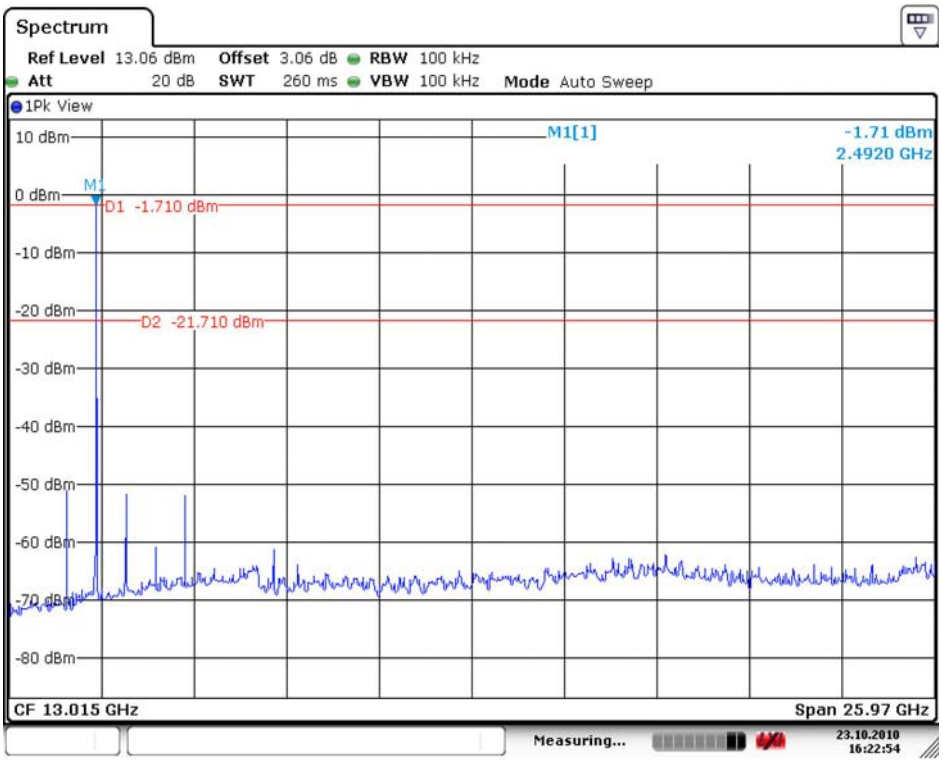
Band – edge (at 20 dB blow) – Low channel
Frequency Range = 30 MHz ~ 10th harmonic



Band – edge (at 20 dB blow) – Mid channel
Frequency Range = 30 MHz ~ 10th harmonic



Band – edge (at 20 dB blow) – High channel
Frequency Range = 30 MHz ~ 10th harmonic



2.1.7 Field Strength of Emissions

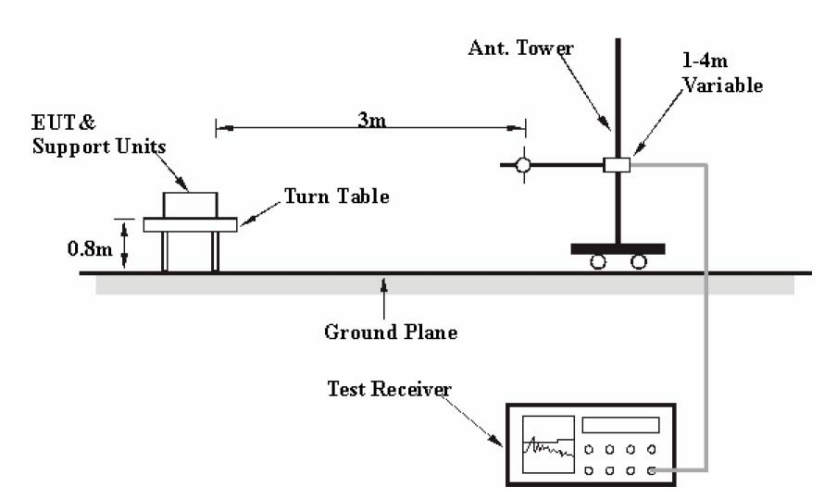
Test Location

☒ Testing was performed at a test distance of 3 meter Open Area Test Site

Test Procedures

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:
Center frequency = the worst channel
Frequency Range =30 MHz ~ 10th harmonic
RBW = 120 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW
= 1 MHz (1 GHz ~ 10th harmonic)
Span = 100 MHz Detector function = Quasi-peak
Trace = max hold



Limit

- **15.209(a)**

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m
30-88	100**	40
88-216	150**	43.5
216-960	200**	46
Above 960	500	54

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequnency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Test Results

EUT	FM Transceiver	Measurement Detail	
Model	PZ-100	Frequency Range	Below 1000MHz
Channel	Normal linking	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
153.45	37.4	6.1	Quasi-Peak

Test Data

No	Emission Frequency (MHz)	Meter Reading dBuV/m	Ant. Polaritr y	Correction Factor dB	Cable Loss dB	Field Strengt h (dBuv/m	Margin (dBuv)	Limit (dBuv/m)
1	30.00	11.2	V	13.2	4.1	28.5	11.5	40.0
2	48.24	16.1	V	13.6	3.9	33.6	6.4	40.0
3	72.14	18.5	V	10.5	3.2	32.2	7.8	40.0
4	89.05	18.7	V	9.4	2.3	30.4	13.1	43.5
5	122.77	19.3	H	12.4	2.4	34.1	9.4	43.5
6	153.45	20.5	H	14.2	2.7	37.4	6.1	43.5
7	178.74	21.7	V	11.9	2.7	36.3	7.2	43.5
8	245.54	23.9	H	11.5	3.1	38.5	7.5	46.0
9	366.65	19.5	H	14.1	3.7	37.4	8.6	46.0
10	433.34	17.1	H	15.5	4.0	36.6	9.4	46.0
11	720.02	11.8	H	19.9	4.9	36.6	9.4	46.0
12	875.10	10.5	V	21.4	5.5	37.4	8.6	46.0

Test Results

EUT	FM Transceiver	Measurement Detail	
Model	PZ-100	Frequency Range	1-25GHz
Channel	Channel 0	Detector function	Average/Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4805.7	47.33/50.60	9.67/23.4	Average/Peak

Test Data

Frequency	Reading A/P	Pol.	Height	Correction Factor			Limits/ Detector A/P	Result A/P	Margin A/P
[MHz]	[dBuV/m]		[m]	Antenna	Amp.Gain	Cable	[dBuV/m]	[dBuV/m]	[dB]
4805.7	35.72/41.98	V	1	33.90	31.60	6.32	54/74	47.33/50.60	9.67/23.4

Remark :

1. We have tested three mode (X, Y, Z).

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency	Reading Peak	Pol.	Height	Correction Factor			Limits/ Detector Peak	Result Peak
[MHz]	[dBuV/m]		[m]	Antenna	Amp.Gain	Cable	[dBuV/m]	[dBuV/m]
2384.7	31.6	V	1.5	28.5	34.6	4.62	74	30.12

Test Results

EUT	FM Transceiver	Measurement Detail	
Model	PZ-100	Frequency Range	1-25GHz
Channel	Channel 39	Detector function	Average/Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4883.5	32.19/42.97	21.81/31.03	Average/Peak

Test Data

Frequency	Reading A/P	Pol.	Height	Correction Factor			Limits/ Detector A/P	Result A/P	Margin A/P
[MHz]	[dBuV/m]		[m]	Antenna	Amp.Gain	Cable	[dBuV/m]	[dBuV/m]	[dB]
4883.5	23.51/34.29	V	1	33.90	31.60	6.38	54/74	32.19/42.97	21.81/31.03

Remark :

1. We have tested three mode (X, Y, Z).

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency	Reading Peak	Pol.	Height	Correction Factor			Limits/ Detector Peak	Result Peak
[MHz]	[dBuV/m]		[m]	Antenna	Amp.Gain	Cable	[dBuV/m]	[dBuV/m]
No emissions were detected at a level greater than 20dB below limit								

Test Results

EUT	FM Transceiver	Measurement Detail	
Model	PZ-100	Frequency Range	1-25GHz
Channel	Channel 78	Detector function	Average/Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	-

Test Data

Frequency	Reading A/P	Pol.	Height	Correction Factor			Limits/ Detector A/P	Result A/P	Margin A/P
[MHz]	[dBuV/m]		[m]	Antenna	Amp.Gain	Cable	[dBuV/m]	[dBuV/m]	[dB]
4964.8	26.1/32.4	V	1	33.90	31.60	6.43	54/74	34.83/41.13	19.17/32.87

Remark :

1. We have tested three mode (X, Y, Z).

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency	Reading Peak	Pol.	Height	Correction Factor			Limits/ Detector Peak	Result Peak
[MHz]	[dBuV/m]		[m]	Antenna	Amp.Gain	Cable	[dBuV/m]	[dBuV/m]
2486.7	40.25	V	1	28.5	34.6	4.62	74	38.77

2.1.8 AC Conducted Emissions

Test Location
Shielded Room

Frequency Range of Measurement
150 kHz to 30 MHz

Instrument Settings
IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.
Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

- 15.207(a)

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

Test Results

☐ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.867	45.03	10.97	Quasi-peak

Test Data

Frequency	Correcton		Phase	Quasi peak			Average		
[MHz]	LISN	Cable		Limit	Measure	Result	Limit	Measure	Result
0.468	0.050	0.010	H	57	38.960	39.020	47	27.430	27.490
0.786	0.050	0.100	N	56	41.310	41.460	46	27.380	27.530
0.858	0.050	0.100	N	56	41.990	42.140	46	31.300	31.450
0.867	0.050	0.100	H	56	44.880	45.030	46	30.820	30.970
0.909	0.051	0.100	H	56	41.910	42.061	46	27.230	27.381
1.539	0.060	0.100	H	56	38.700	38.860	46	26.860	27.020

APPENDIX A – Test Equipment Used For Tests

c	Description	Manufacturer	Model No.	Serial No.	Due Cal.
1	Test Receiver	Rohde & Schwarz	ESHS 10	862970/018	2011.05.06
2	Test Receiver	Rohde & Schwarz	ESVS 10	826008/014	2011.05.06
3	Spectrum Analyzer	Hewlett Packard	8566B	2311A02394	2011.05.06
4	Spectrum Analyzer	Rohde & Schwarz	FSV30	100736	2010.12.01
5	Modulation Analyzer	Hewlett Packard	8901B	3438A05094	2011.05.06
6	Audio analyzer	Hewlett Packard	8903B	3011A12915	2011.05.06
7	Preamplifer	Hewlett Packard	8447F	2805A02570	2011.05.06
8	Preamplifer	A.H. Systems	PAM-0118	164	2011.05.06
9	Signal Generator	Hewlett Packard	8673D	2708A00448	2011.05.06
10	Power Meter	Hewlett Packard	437B	312U24787	2011.05.06
11	Power Sensor	Hewlett Packard	8482B	3318A06943	2011.05.06
12	Loop Antenna	Rohde & Schwarz	HFH2-Z2.335.4711.52	826532/006	2011.02.06
13	Dipole Antenna	Rohde & Schwarz	VHAP	574	2011.07.07
14	Dipole Antenna	Rohde & Schwarz	VHAP	575	2011.07.17
15	Dipole Antenna	Rohde & Schwarz	UHAP	545	2011.07.17
16	Dipole Antenna	Rohde & Schwarz	UHAP	546	2011.07.07
17	Biconical Antenna	Eaton Corp.	94455-1	0977	2011.07.03
18	Biconical Antenna	EMCO	3104C	9111-2468	2011.07.03
19	Log Periodic Antenna	EMCO	3146	2051	2011.06.05
20	Log Periodic Antenna	EMCO	3146	8901-2320	2011.07.03
21	Horn Antenna	A.H. Systems	SAS-571	414	2011.03.16
22	Waveform Generator	Hewlett Packard	33120A	US34001190	2011.05.06
23	Digital Oscilloscope	Tektronix	TDS 340A	B012287	2011.05.06
24	Dummy Load	Bird Electronics	8251	11511	2011.05.06

Test Setup Photos and Configuration

Conducted Voltage Emissions

Radiated Electric Field Emissions