TEST REPORT For FCC

Test Report No.	: TK-FR10049
Date of Issue	: 12/09/2010
FCC ID	: YZEI-SCOPERX
Description of Product	: Wireless Receiver
Model No.	: i-scope RX
Applicant	: DONGJIN MEDICAL Co., Ltd. 1654-1 Donghwa-ri Munmak-eup Wonju-si, Gangwon-do, Korea
Manufacturer	: DONGJIN MEDICAL Co., Ltd. 1654-1 Donghwa-ri Munmak-eup Wonju-si, Gangwon-do, Korea
Standards	: FCC Part 15.247
Test Date	: 11/29/2010 - 12/09/2010
Test Results	: ☒ PASS ☐ FAIL

The test results relate only to the items tested.

Tested by:
Kyu-Chul Shin
Test Engineer
Date:12/09/2010

Reviewed by:
KT Kang
Technical Manager
Date: 12/09/2010

THRU-KES CO.,LTD.
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TABLE OF CONTENTS

1.0 General Product Description

Equipment model name	: i-scope RX
Serial number	: Prototype
EUT condition	: Pre-production, not damaged
Antenna type	: chip antenna Gain 2dBi
Frequency Range	: 2402 ~ 2480 MHz
RF output power	: 7.70 dBm Peak Conducted
Number of channels	: 38
Type of Modulation(Data Rate)	: GFSK
Power Source	: DC 3.7V

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz)	2404	2444	2479

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
Low,Mid, High	FHSS	GFSK

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	DONGJIN MEDICAL Co., Ltd.	i-scope RX	-	-
Notebook	F U J I T S U L T D	LIFEBOOK S-5582	434230343466	DoC

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	< 1W		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	C

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

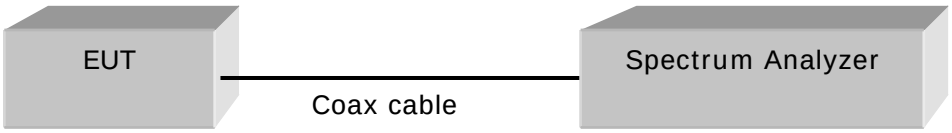


Figure 1 : Measurement setup for the carrier frequency seperation

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

Frequency (MHz)	Adjacent Hopping Channel Separation (MHz)	Minimum Bandwidth (kHz)	Result
2444	2.02	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

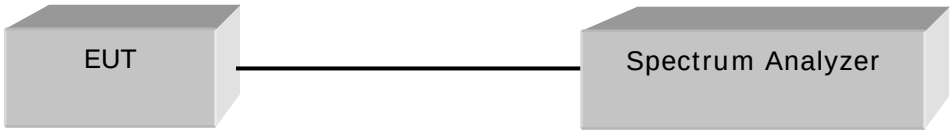
Test Procedures

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

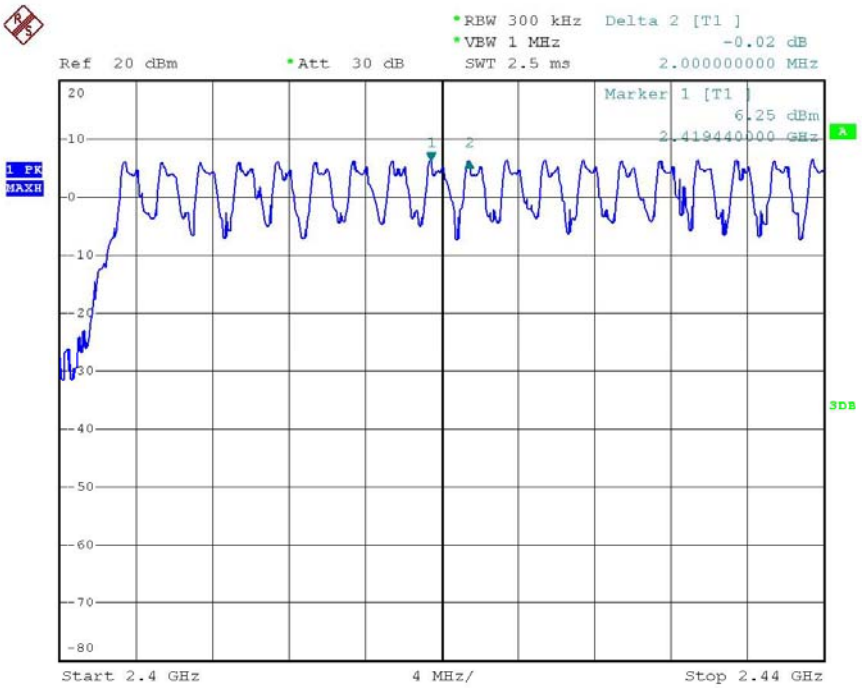
The EUT in the 2400-2483.5 MHz band shall use at least 15 channels.

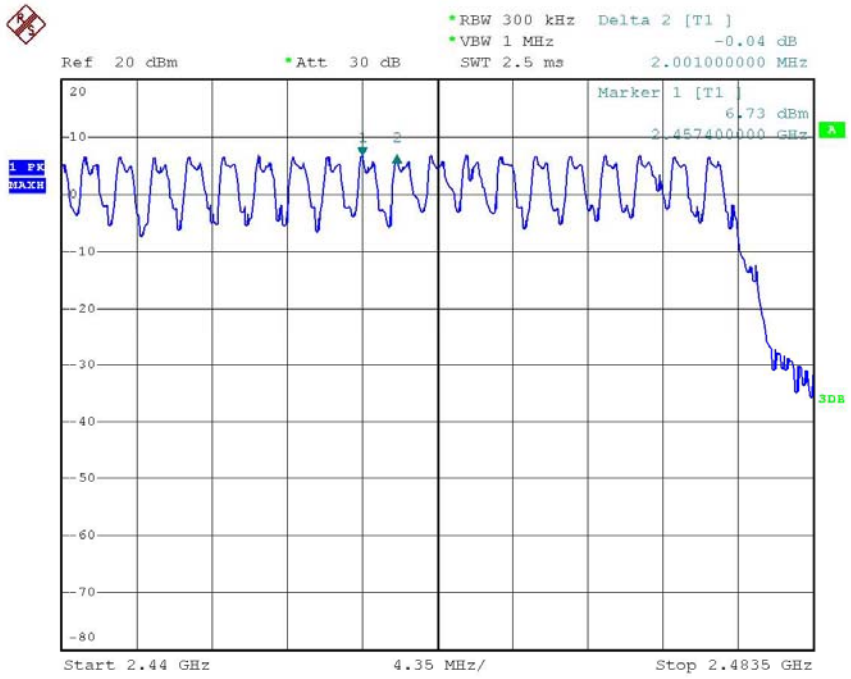
Test Results

Total number of Hopping Channels	Result
38	Complies

See next pages for actual measured spectrum plots.

Number of Hopping Frequencies





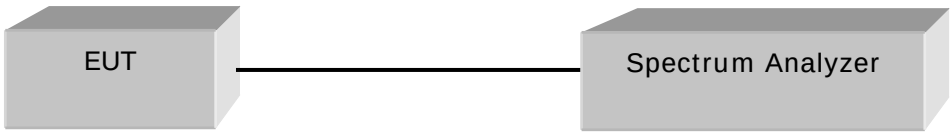
2.1.3 20 dB bandwidth

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



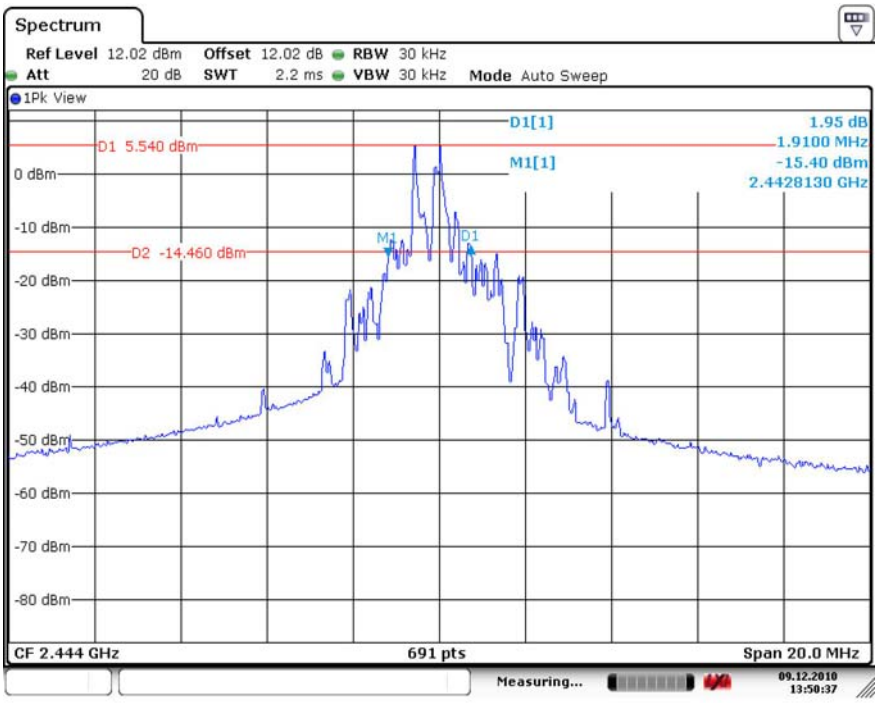
Test Results

Data Rate : GFSK

Frequency (MHz)	Measured Bandwidth (MHz)	Result
2444	1.91	Complies

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

20 dB Bandwidth
Data Rate : GPSK



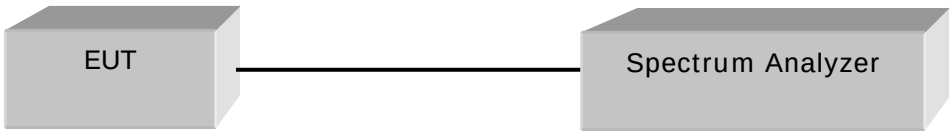
2.1.4 Time of Occupancy (Dwell Time)

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

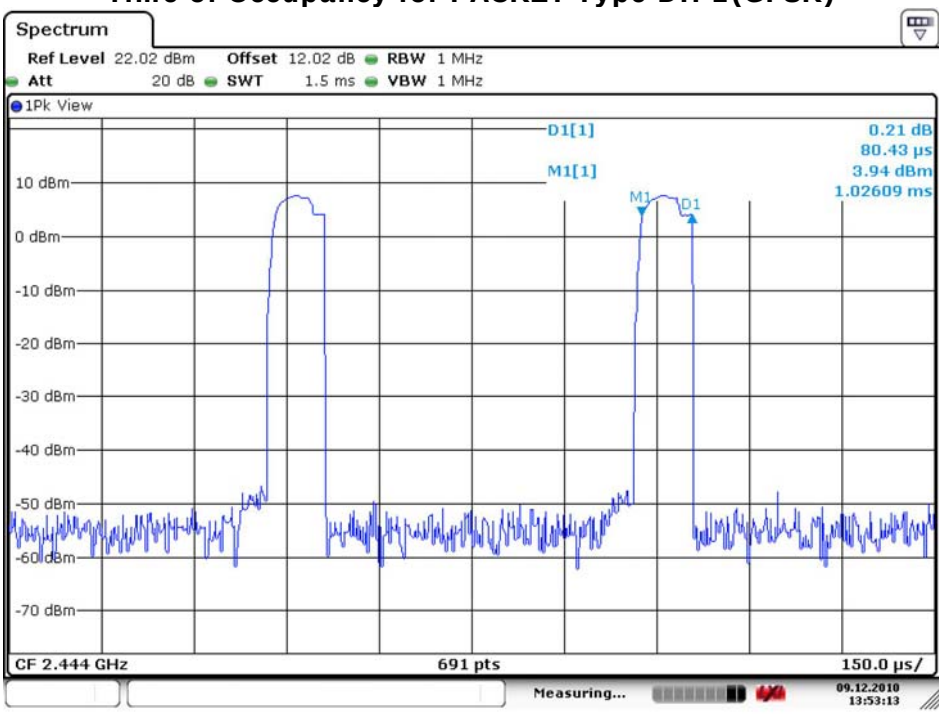
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Results

Channel Frequency (MHz)	Test Results	
	Dwell Time (ms)	Result
2444	328.11	Complies

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

Time of Occupancy for PACKET Type DH 1(GFSK)



Date: 9.DEC.2010 13:53:12

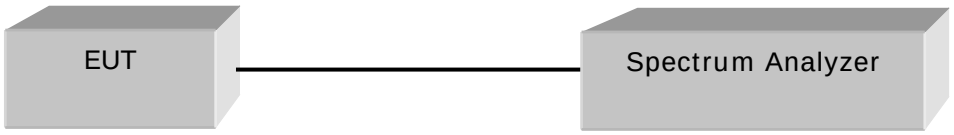
2.1.5 Maximum peak Conducted Output Power

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

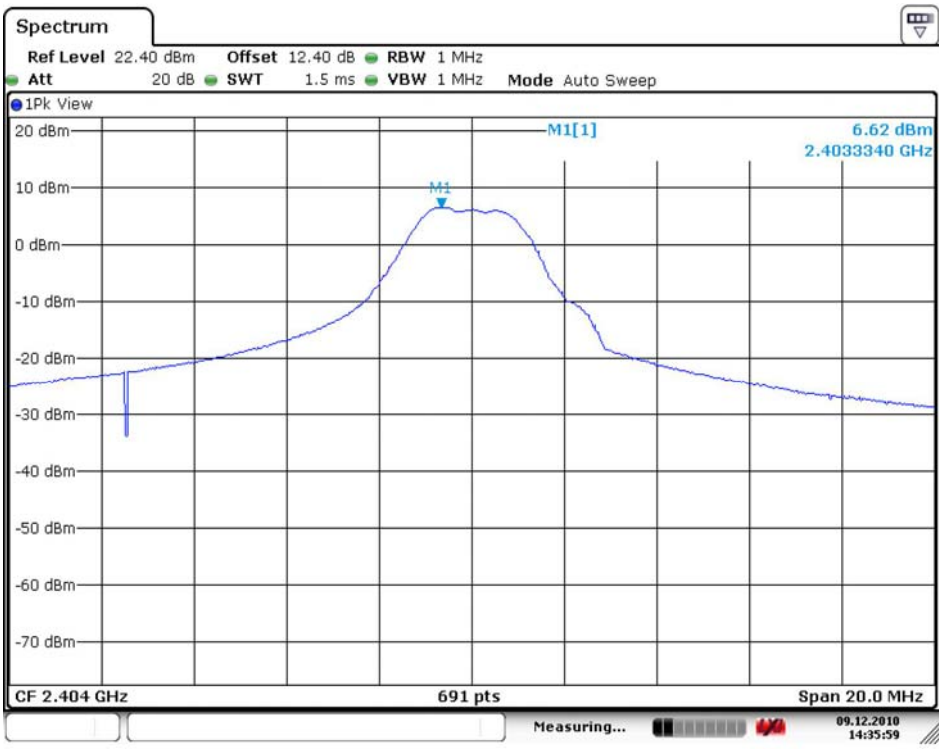
Test Results

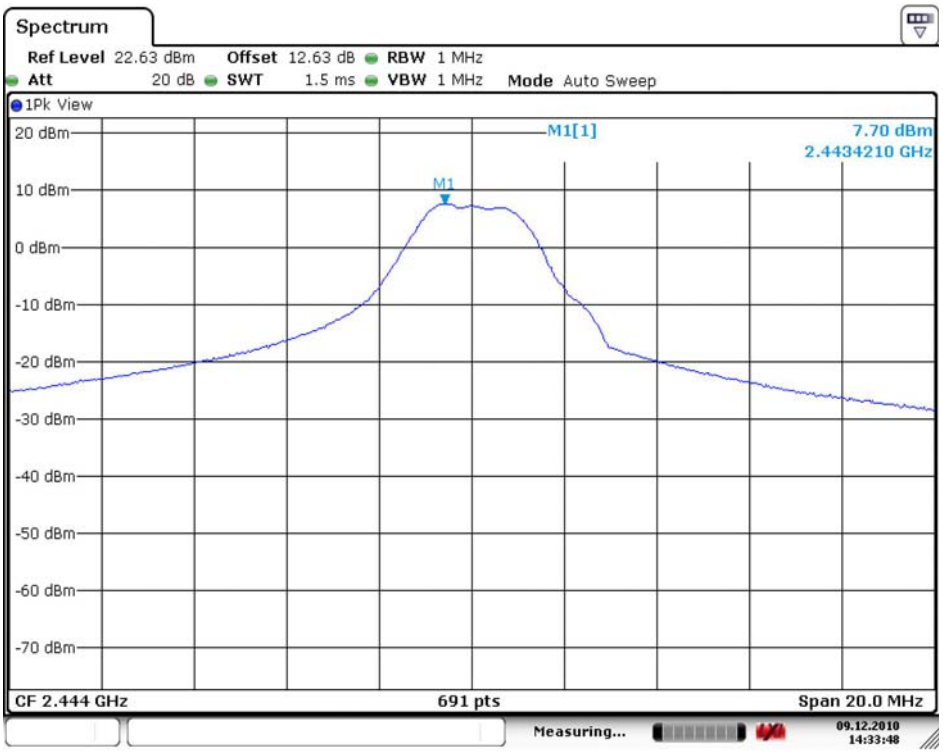
Data Rate : GPSK

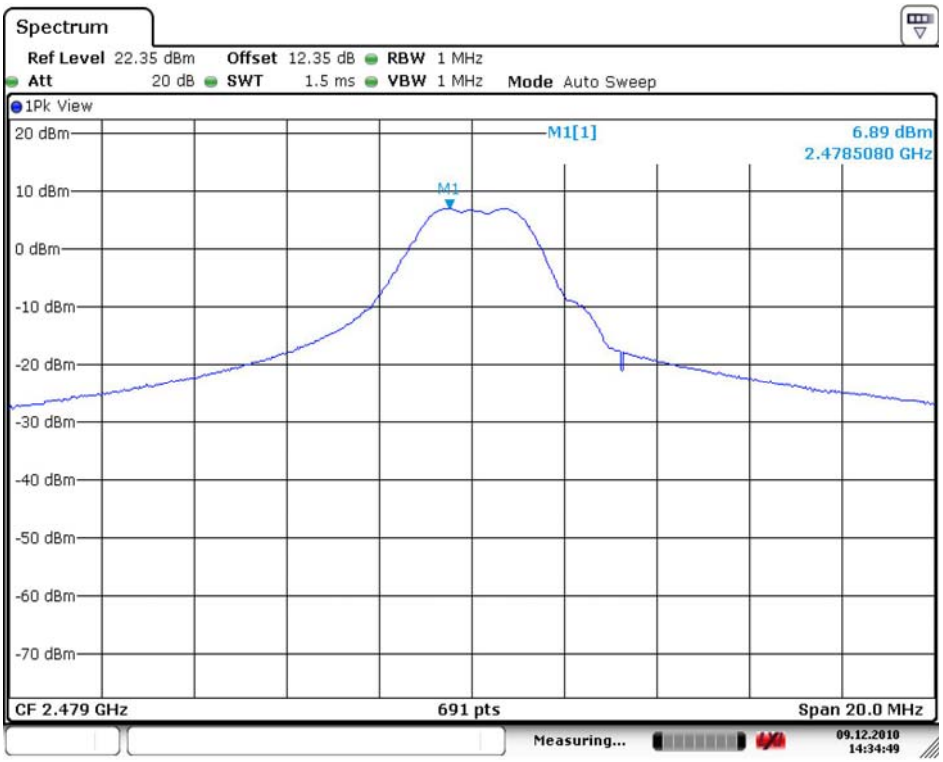
Frequency (MHz)	Peak output power(dBm)	Peak output power(mW)	Result
2404	6.62	4.59	Complies
2444	7.70	5.88	Complies
2479	6.89	4.88	Complies

See next pages for actual measured spectrum plots.

Maximum peak Conducted Output Power - GFSK







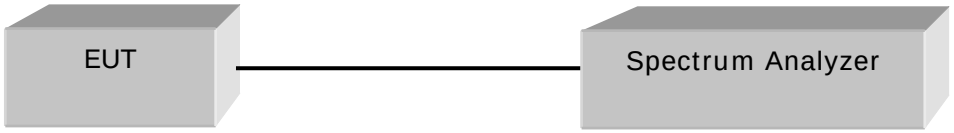
2.1.6 Band-edge

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
Trace = max hold
Detector function = peak
Sweep = auto



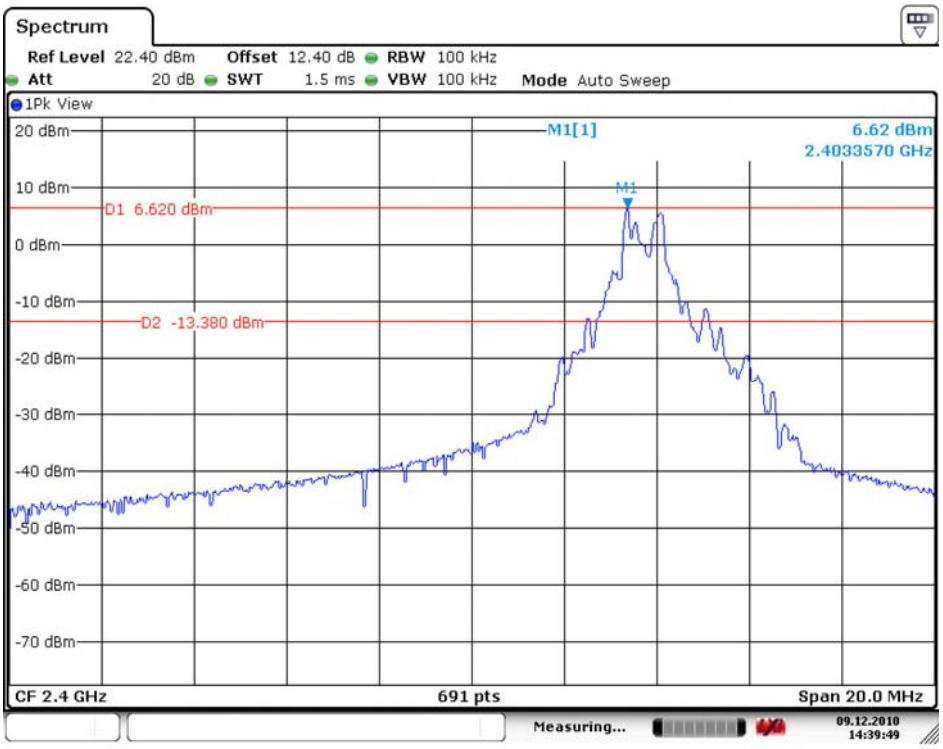
Limit

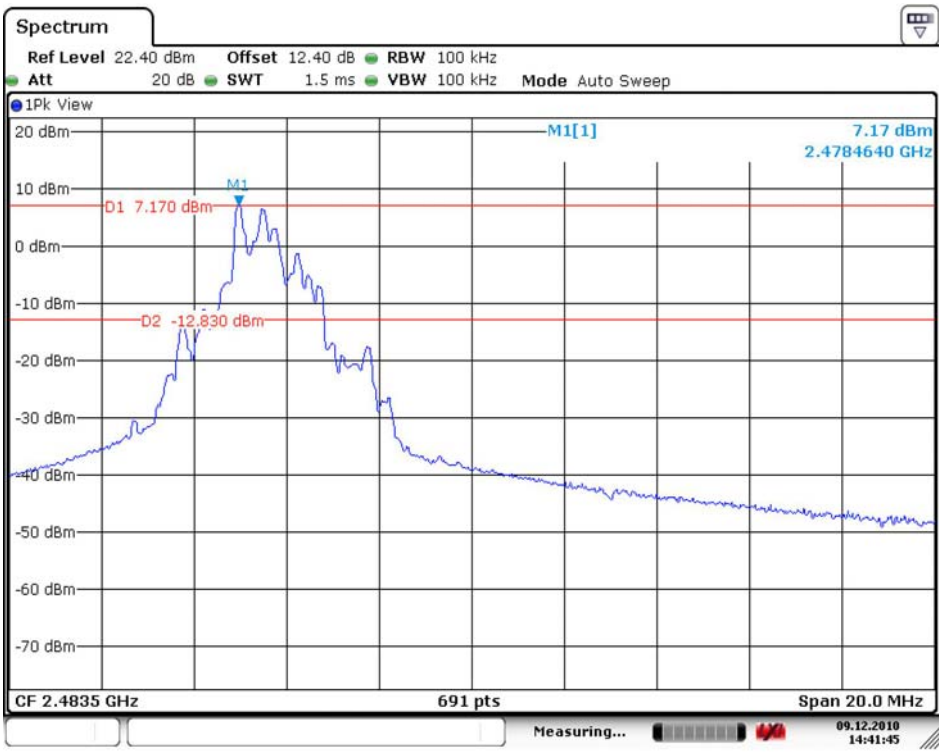
> 20 dBc

Test Results

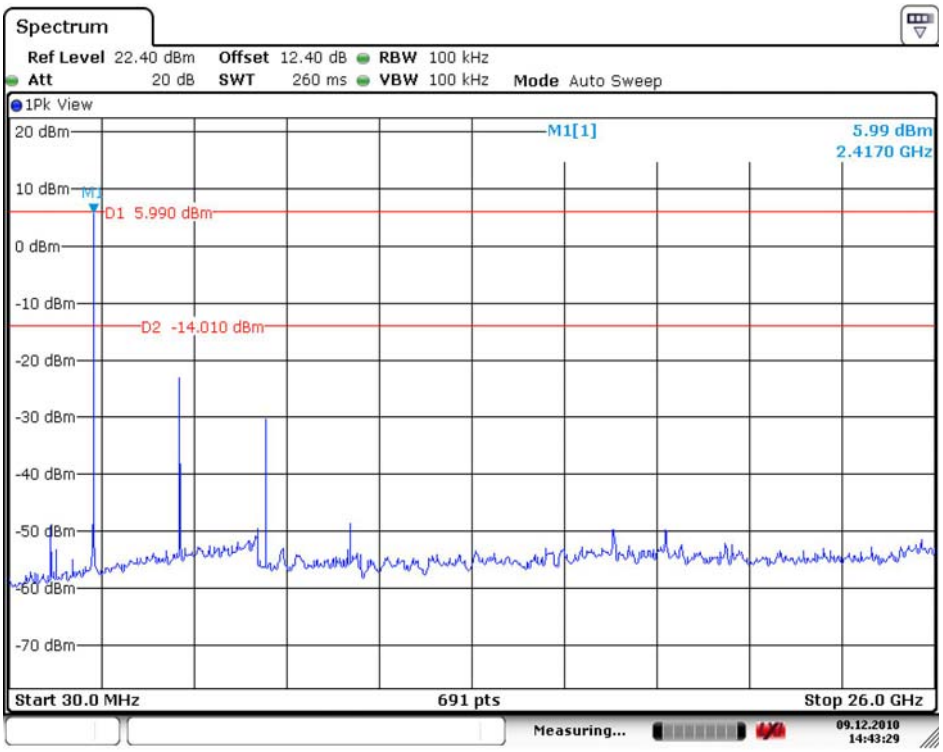
All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest inband spectral density.
Therefore the applying equipment meets the requirement.
See next pages for actual measured spectrum plots.

Band – edge - GFSK

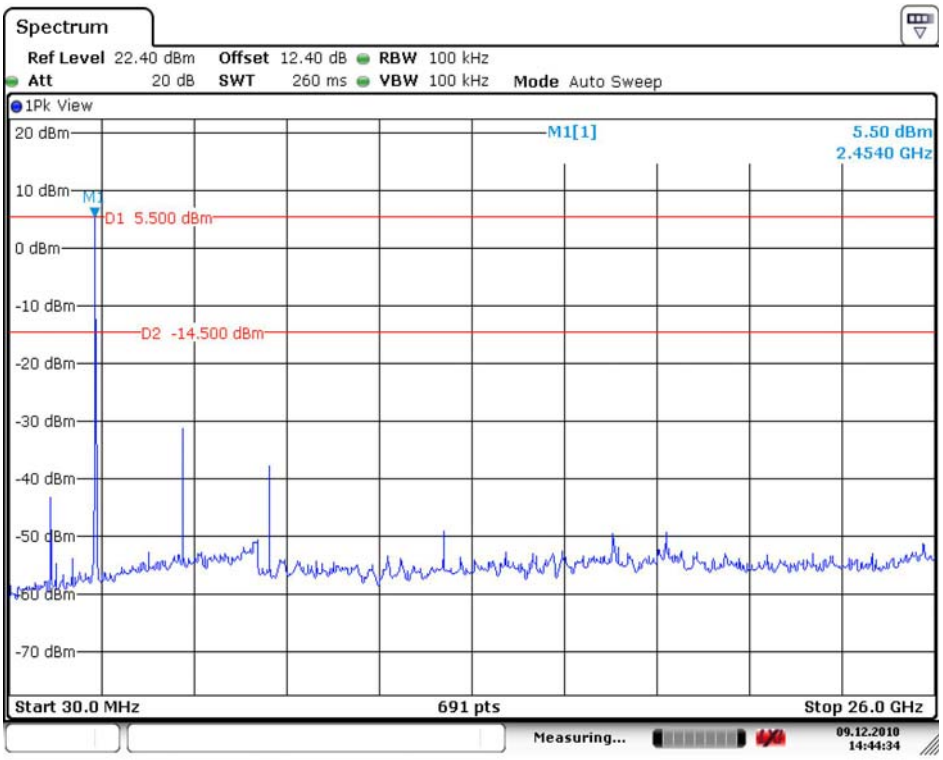




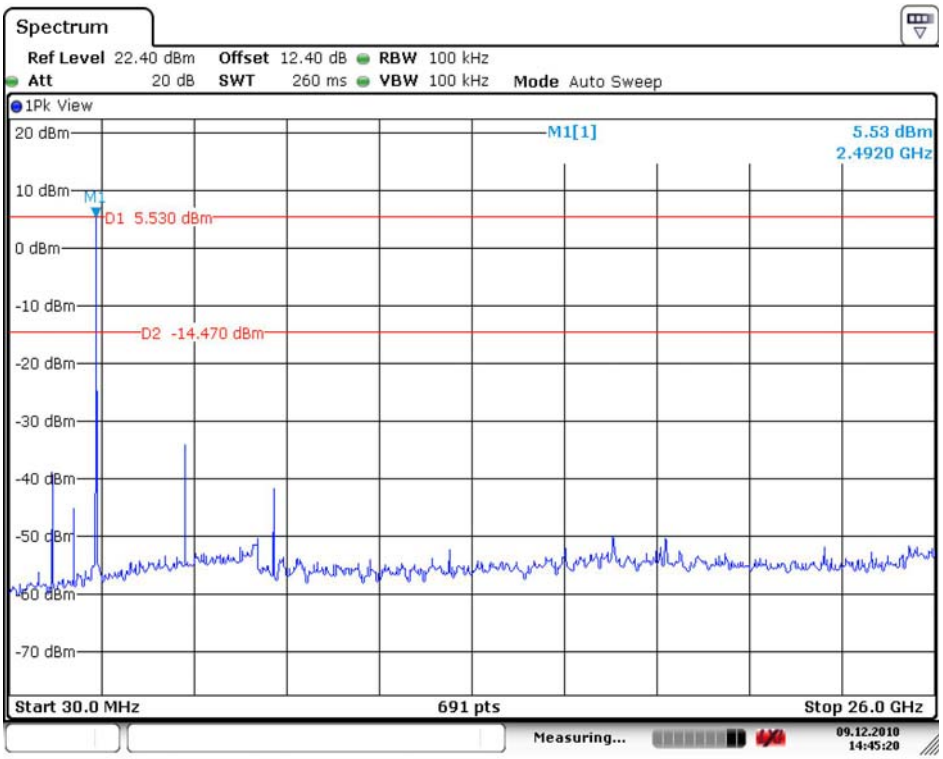
Band – edge (at 20 dB blow) – Low channel
Frequency Range = 30 MHz ~ 10th harmonic



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

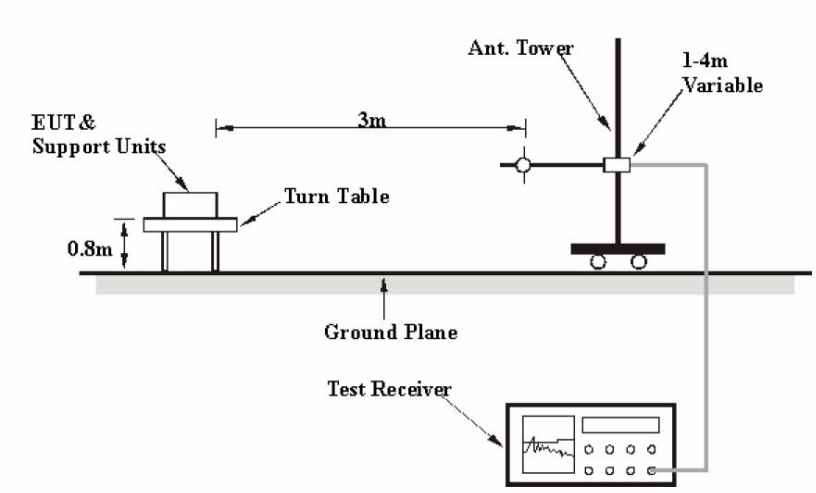
Test Location

☒ 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	Wireless Receiver	Measurement Detail	
Model	i-scope RX	Frequency Range	Below 1000MHz
Channel	Normal linking	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
214.60	38.10	5.40	Quasi-Peak

Test Data

No	Emission Frequency (MHz)	Meter Reading dBuV/m	Ant. Polaritry	Correction Factor dB	Cable Loss dB	Field Strength (dBuv/m)	Margin (dBuv)	Limit (dBuv/m)
1	36.30	16.5	V	10.45	3.14	30.09	9.91	40
2	114.90	18.2	V	13.43	2.00	33.63	9.87	43.5
3	214.60	19.5	V	15.91	2.69	38.10	5.40	43.5
4	244.10	19.1	V	15.72	2.86	37.68	8.32	46
5	258.10	19.6	V	16.51	2.93	39.04	6.96	46
6	472.90	17.1	V	17.10	4.16	38.36	7.64	46

Test Results

EUT	Wireless Receiver	Measurement Detail	
Model	i-scope RX	Frequency Range	1-25GHz
Detector function			Average/Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4807.99	48.88/53.53	5.12/20.47	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]
4807.99	40.26/44.91	V	1	33.90	31.60	6.32	54/74	48.88/53.53	5.12/20.47

Remark :

1. We have tested three mode (X, Y, Z).
2. Test mode is GFSK

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	Cable	[dBuV/m]	[dBuV/m]
2389.94	18.16	V	1.0	27.42	4.62	74	50.20
2484.84	13.48	V	1.0	27.42	4.84	74	45.74

Test Results

EUT	Wireless Receiver	Measurement Detail	
Model	i-scope RX	Frequency Range	1-25GHz
		Detector function	Average/Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4887.86	42.80/48.84	11.20/25.16	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]
4887.86	34.12/40.16	V	1.0	33.90	31.60	6.38	54/74	42.80/48.84	11.20/25.16

Remark :
1. We have tested three mode (X, Y, Z).
2. Test mode is GFSK

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	Cable	[dBuV/m]	[dBuV/m]
2387.97	15.24	V	1.0	28.5	4.62	74	48.36
2484.25	13.95	V	1.0	28.5	4.84	74	47.29

Test Results

EUT	Wireless Receiver	Measurement Detail	
Model	i-scope RX	Frequency Range	1-25GHz
Channel	Channel 78	Detector function	Average/Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4957.97	38.26/40.35	7.01/24.92	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]
4957.97	38.26/40.35	V	1	33.90	31.60	6.43	54/74	46.99/49.08	7.01/24.92

* No emissions were detected at a level greater than 20dB below limit

Remark :
1. We have tested three mode (X, Y, Z).
2. Test mode is GFSK

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	Cable	[dBuV/m]	[dBuV/m]
2387.37	15.68	V	1.0	28.5	4.62	74	48.80
2483.51	17.72	V	1.0	28.5	4.84	74	51.06

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

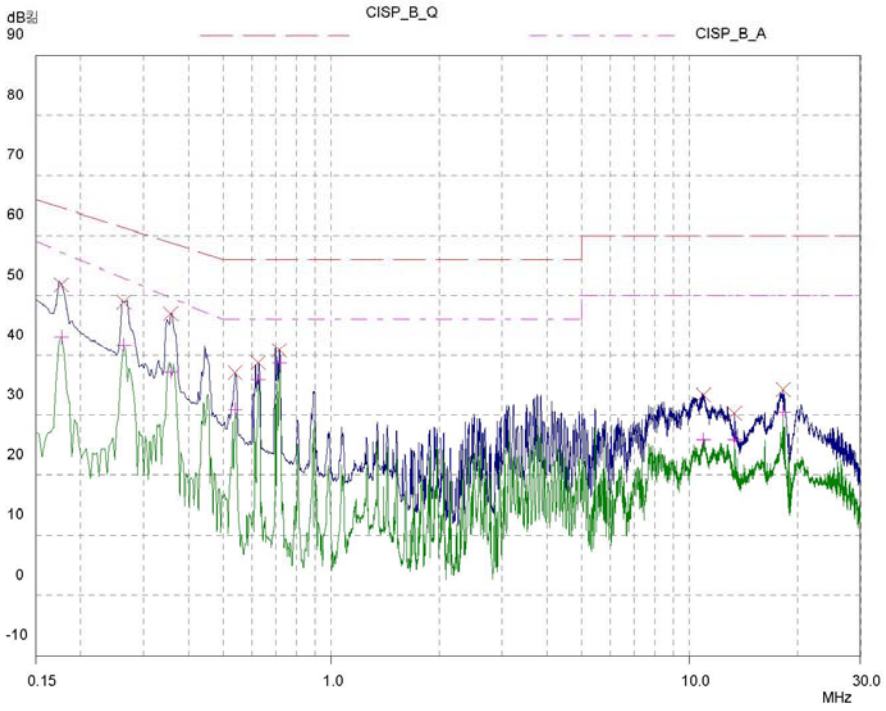
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.357	47.194	11.604	Quasi-peak

Test Data

frequency	Correction		Phase	Quasi peak			Average		
[MHz]	LISN	Cable Loss	Hot/ Neutral	Limit	Measure	Result	Limit	Measure	Result
0.270	0.057	0.100	H	61.1	41.780	41.937	51.1	32.140	32.297
0.321	0.058	0.100	H	59.7	39.040	39.198	49.7	29.800	29.958
0.456	0.050	0.100	H	56.8	35.470	35.620	46.8	23.300	23.450
1.044	0.060	0.121	H	56.0	27.090	27.271	46.0	23.540	23.721
2.235	0.065	0.152	H	56.0	29.000	29.216	46.0	14.900	15.116
3.621	0.089	0.100	H	56.0	32.090	32.279	46.0	26.230	26.419
10.749	0.333	0.100	H	60.0	29.210	29.643	50.0	22.940	23.373
17.886	0.685	0.106	H	60.0	34.930	35.721	50.0	25.600	26.391
17.940	0.688	0.103	H	60.0	35.490	36.281	50.0	28.670	29.461
0.177	0.104	0.100	N	64.6	51.810	52.014	54.6	43.070	43.274
0.264	0.077	0.100	N	61.3	48.920	49.097	51.3	41.700	41.877
0.357	0.064	0.100	N	58.8	47.030	47.194	48.8	37.230	37.394
0.540	0.050	0.100	N	56.0	37.050	37.200	46.0	30.900	31.050
0.627	0.050	0.100	N	56.0	38.720	38.870	46.0	35.920	36.070
0.717	0.050	0.100	N	56.0	40.800	40.950	46.0	38.680	38.830
10.929	0.351	0.100	N	60.0	33.310	33.761	50.0	25.890	26.341
13.359	0.452	0.160	N	60.0	30.310	30.921	50.0	25.950	26.561
18.246	0.750	0.100	N	60.0	34.220	35.070	50.0	30.470	31.320

[HOT]



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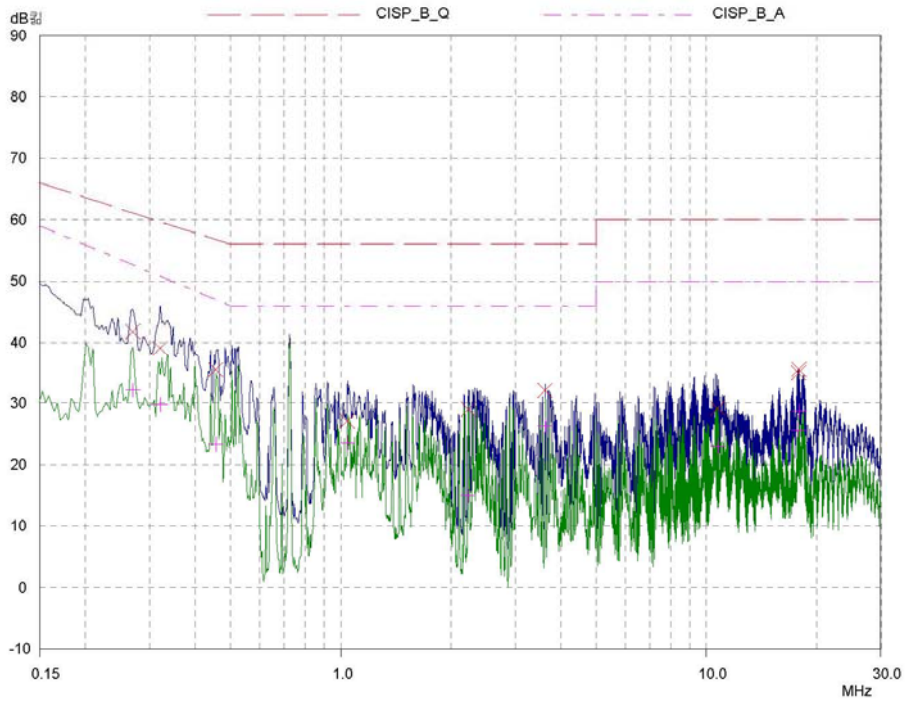

APPENDIX A – Test Equipment Used For Tests

No	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	2011.12.01
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