FCC TEST REPORT

CATEGORY	:	Portable
PRODUCT NAME	:	Bluetooth Stereo Headset
FCC ID.	:	PQY-4710874203396
FILING TYPE	:	Certification
BRAND NAME	:	Cellink
MODEL NAME	:	BTST-9000
APPLICANT	:	**CELLINK CO., LTD** 4F, No. 100, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei, Taiwan, R.O.C.
MANUFACTURER	:	**CELLINK CO., LTD** 4F, No. 100, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei, Taiwan, R.O.C.
ISSUED BY	:	**SPORTON INTERNATIONAL INC.** 6F, No. 106, Sec. 1, Hsin Tai Wu Rd., His Chih, Taipei Hsien, Taiwan, R.O.C.

Statements:

The test result in this report refers exclusively to the presented test model / sample.
Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

Certificate or Test Report could not be used by the applicant to claim the product endorsement by CNLA and any agency of U.S. government.

The test equipment used to perform the test is calibrated and traceable to NML/ROC or NIST/USA.

1190
ILAC MRA

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HISTORY OF THIS TEST REPORT

Received Date: Feb. 17, 2005
Test Date: Mar. 25, 2005
Original Report Issue Date: Apr. 9, 2005
Report No.: FR521708

■ No additional attachment.
☐ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

CERTIFICATE OF COMPLIANCE

with

47 CFR FCC Part 15 Subpart C

PRODUCT NAME	:	Bluetooth Stereo Headset
BRAND NAME	:	Cellink
MODEL NAME	:	BTST-9000
APPLICANT	:	**CELLINK CO., LTD** 4F, No. 100, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei, Taiwan, R.O.C.
MANUFACTURER	:	**CELLINK CO., LTD** 4F, No. 100, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei, Taiwan, R.O.C.

I **HEREBY** CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in ANSI C63.4-2003 and all test are performed according to 47 CFR FCC Part 15 Subpart C. Testing was carried out on Mar. 25, 2005 at SPORTON International Inc. LAB.

Dr. Alan Lane
Vice General Manager
Sporton International Inc.

1. General Description of Equipment under Test

1.1. Applicant

CELLINK CO., LTD

4F, No. 100, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei, Taiwan, R.O.C.

1.2. Manufacturer

CELLINK CO., LTD

4F, No. 100, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei, Taiwan, R.O.C.

1.3. Basic Description of Equipment under Test

This product is a Bluetooth headset stereo. The technical data has been listed on section " Features of Equipment under Test ".

1.4. Features of Equipment under Test

Items	Description
Type of Modulation	GFSK
Number of Channels	79
Frequency Band	2400 MHz ~ 2483.5 MHz
Carrier Frequency	See section 1.6 for details
Data Rate	1Mbps
Channel Bandwidth	1MHz
Max. Peak Power	0.04 dBm
Antenna Type	See section 1.5 for details
Testing Duty Cycle	46.40%
Test Power Source	3.7V DC from battery
Temperature Range (Operating)	0 ~ 55 °C

1.5. Antenna Description

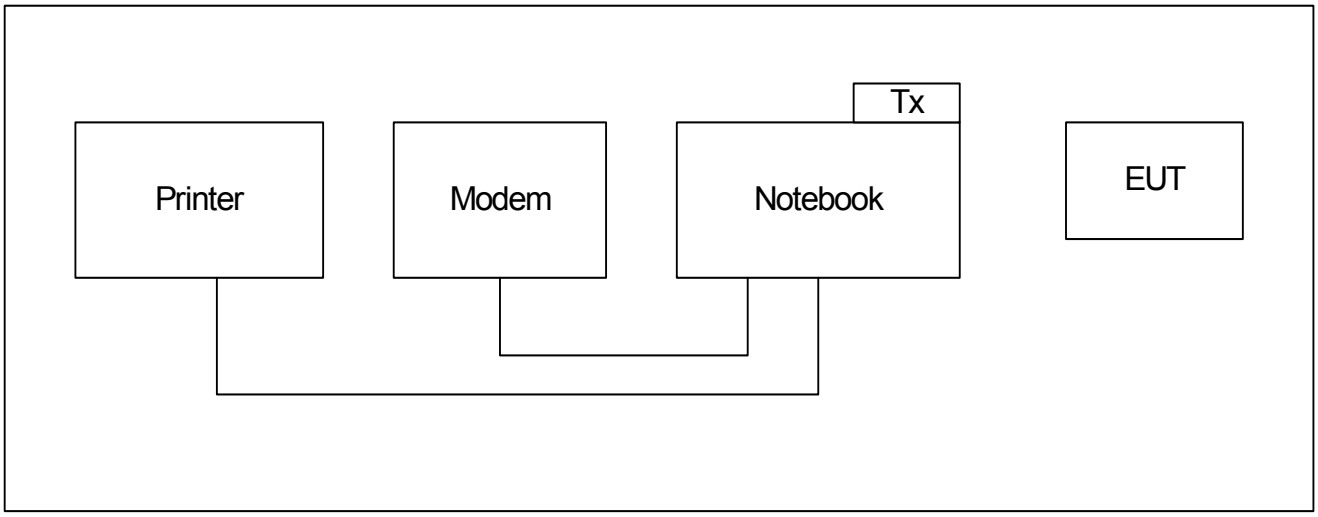
No.	Antenna Type	Gain (dBi)
1	Chip Antenna	1.00

1.6. Table for Carrier Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	20	2422 MHz	40	2442 MHz	60	2462 MHz
01	2417 MHz	21	2423 MHz	41	2443 MHz	61	2463 MHz
02	2422 MHz	22	2424 MHz	42	2444 MHz	62	2464 MHz
03	2427 MHz	23	2425 MHz	43	2445 MHz	63	2465 MHz
04	2403 MHz	24	2426 MHz	44	2446 MHz	64	2466 MHz
05	2404 MHz	25	2427 MHz	45	2447 MHz	65	2467 MHz
06	2405 MHz	26	2428 MHz	46	2448 MHz	66	2468 MHz
07	2406 MHz	27	2429 MHz	47	2449 MHz	67	2469 MHz
08	2407 MHz	28	2430 MHz	48	2450 MHz	68	2470 MHz
09	2408 MHz	29	2431 MHz	49	2451 MHz	69	2471 MHz
10	2409 MHz	30	2432 MHz	50	2452 MHz	70	2472 MHz
11	2410 MHz	31	2433 MHz	51	2453 MHz	71	2473 MHz
12	2411 MHz	32	2434 MHz	52	2454 MHz	72	2474 MHz
13	2412 MHz	33	2435 MHz	53	2455 MHz	73	2475 MHz
14	2413 MHz	34	2436 MHz	54	2456 MHz	74	2476 MHz
15	2414 MHz	35	2437 MHz	55	2457 MHz	75	2477 MHz
16	2415 MHz	36	2438 MHz	56	2458 MHz	76	2478 MHz
17	2416 MHz	37	2439 MHz	57	2459 MHz	77	2479 MHz
18	2417 MHz	38	2440 MHz	58	2460 MHz	78	2480 MHz
19	2418 MHz	39	2441 MHz	59	2461 MHz		

2. Test Configuration of the Equipment under Test

2.1. Connection Diagram of Test System



2.2. The Test Mode Description

1. For FHSS modulation, GFSK is the worst case on all test items.
2. According to ANSI C63.4-2003: If frequency range of EUT is more than 10 MHz, we have to test the lowest, middle and highest channels of EUT.
3. Spurious emission below 1GHz is independent of channel selection, so only channel 78 with GFSK modulation was tested.
4. AC conduction emission is independent of channel selection, so only channel 78 with GFSK modulation was tested.

2.3. Description of Test Supporting Units

Support unit	Brand	Model No.	FCC ID	Data cable (m)
Notebook	DELL	PP01L	Yes	-
Printer	EPSON	Stylus Color 061	Yes	1.70
Modem	ACEEX	DM1414	Yes	1.15

3. General Information of Test

3.1. Test Facility

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.
: TEL 886-3-327-3456
: FAX 886-3-318-0055

Test Site No : 03CH03-HY / TH01-HY

3.2. Standards for Methods of Measurement

Here is the list of the standards followed in this test report.

ANSI C63.4-2003

47 CFR FCC Part 15 Subpart C

3.3. DoC Statement

This EUT is also classified as a device of computer peripheral Class B which DoC has to be followed. It has been verified according to the rule of 47 CFR part 15 Subpart B, and found that all the requirements has been fulfilled.

3.4. Frequency Range Investigated

Radiated emission test: from 30 MHz to 10th carrier harmonic

3.5. Test Distance

The test distance of radiated emission (30MHz~1GHz) test from antenna to EUT is 3 M.
The test distance of radiated emission (1GHz~10th carrier harmonic) test from antenna to EUT is 3 M.

3.6. Test Software

During testing, Channel & Power Controlling Software: This was provided by the manufacturer and is able to let the test engineer select the operating channel as well as the RF output power. The parameters for channel selection is trying to offer the test engineer the ability to fix the operating channel for testing, both normal data and continuously transmitting modes are allowed, and that for RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameter Table

Test Software	**Bluetest**		
Test Channel	CH 00	CH 39	CH 79
Test Frequency	2402MHz	2441MHz	2480MHz
TX Power	255/53	255/55	255/55

4. List of Measurements

4.1. Summary of the Test Results

Applied Standard: 47 CFR FCC Part 15 Subpart C			
Paragraph	**FCC Section**	**Description of Test**	**Result**
5.1	15.247(a)(1)	Hopping Channel Bandwidth	Pass
5.2	15.247(a)(1)	Hopping Channel Separation	Pass
5.3	15.247(b)(1)	Number of Hopping Frequency Used	Pass
5.4	15.247(a)(1)(iii)	Dwell Time of Each Frequency	Pass
5.5	15.247(b)(1)	Maximum Peak Output Power	Pass
5.6	15.247(d)	Band Edges Emission	Pass
5.7	15.207	AC Power Line Conducted Emission	Pass
5.8	15.247(d)	Spurious Radiated Emission	Pass
5.9	15.203/15.247(b)/(c)	Antenna Requirement	Pass

5. Test Result

5.1. Test of Hopping Channel Bandwidth

5.1.1. Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.1.2. Measuring Instruments

Item 18 of the table is on section 6.

5.1.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2441 MHz / 2480 MHz
  Span Frequency : > 20dB Bandwidth
  RB : 30 kHz
  VB : 100 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

5.1.4. Test Procedures

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 30KHz and VBW to 100KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.
4. The spectrum width with level higher than 20dB below the peak level.
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.1.5. Test Setup Layout

5.1.6. Test Criteria

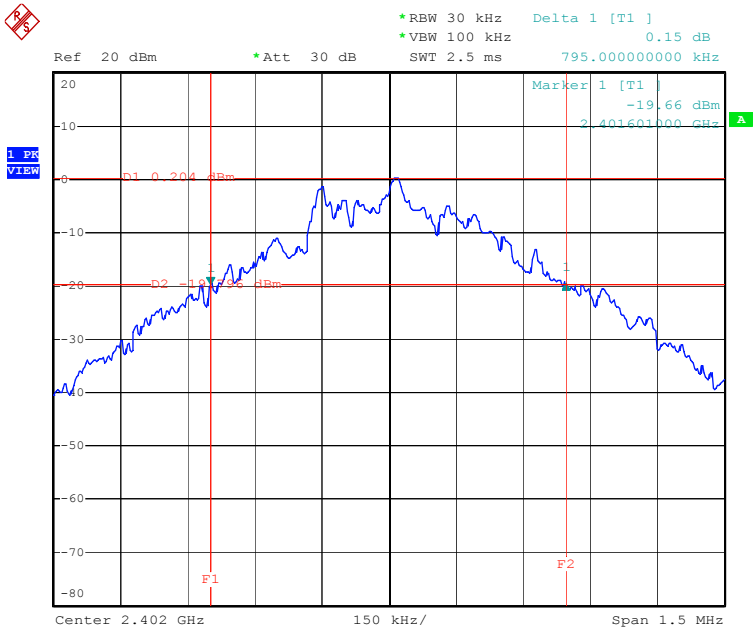
All test results complied with the requirements of Section 15.247(a)(1). Measurement Uncertainty is $1x10^{-5}$.

5.1.7. Test Result

- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Modulation Type	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	Min. Limit (kHz)
GFSK	00	2402 MHz	795.00	25
GFSK	39	2441 MHz	819.00	25
GFSK	78	2480 MHz	849.00	25

Modulation Type: GFSK (Channel 00) :



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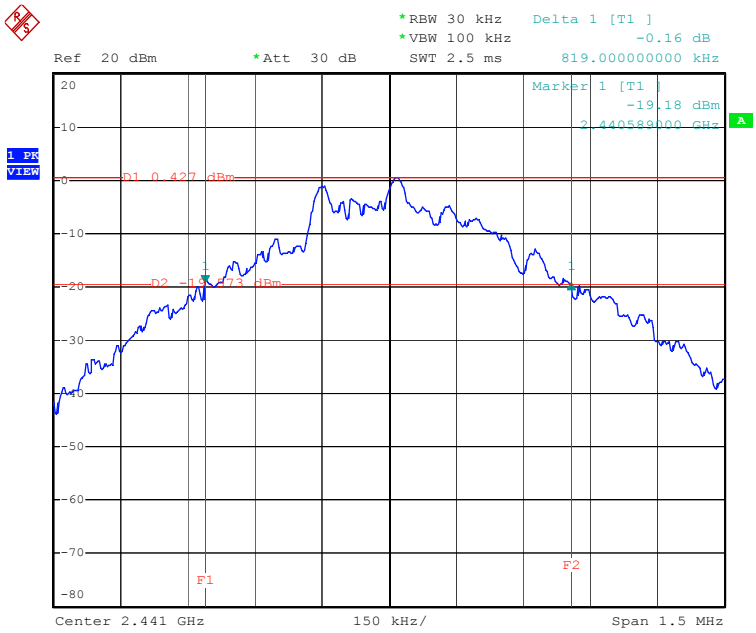
Modulation Type: GFSK (Channel 39) :



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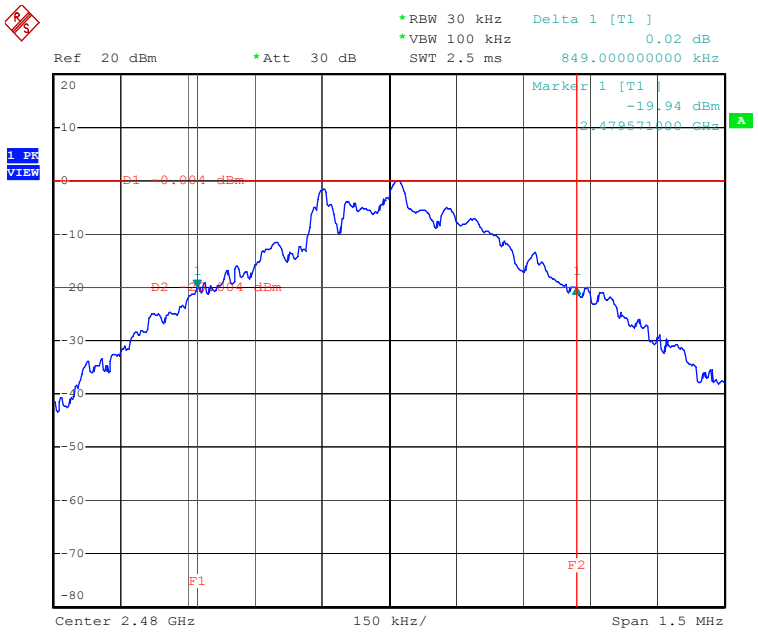
Modulation Type: GFSK (Channel 78)：



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5.2. Test of Hopping Channel Separation

5.2.1. Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.2.2. Measuring Instruments

Item 18 of the table is on section 6.

5.2.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2441 MHz / 2480 MHz
  Span Frequency : > One time channel separation
  RB : 100 kHz
  VB : 100 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

5.2.4. Test Procedures

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.
4. The Hopping Channel Separation is defined as the separation between 2 neighboring hopping frequencies.
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.2.5. Test Setup Layout

5.2.6. Test Criteria

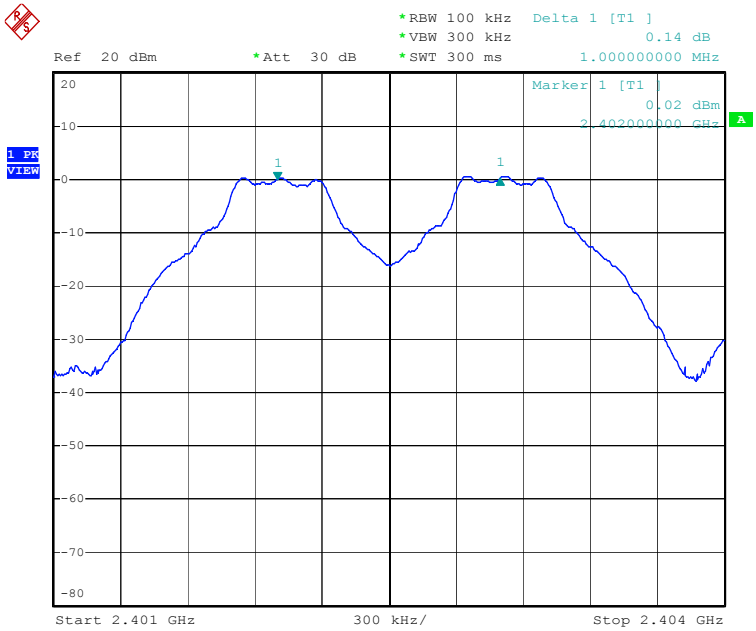
All test results complied with the requirements of Section 15.247(a)(1). Measurement Uncertainty is $1x10^{-5}$.

5.2.7. Test Result

- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Modulation Type	Channel No.	Frequency (MHz)	Hopping Channel Separation (kHz)	Min. Limit (kHz)
GFSK	00	2402 MHz	1000	795.00
GFSK	39	2441 MHz	1000	819.00
GFSK	78	2480 MHz	1000	849.00

Modulation Type: GFSK (Channel 00) :



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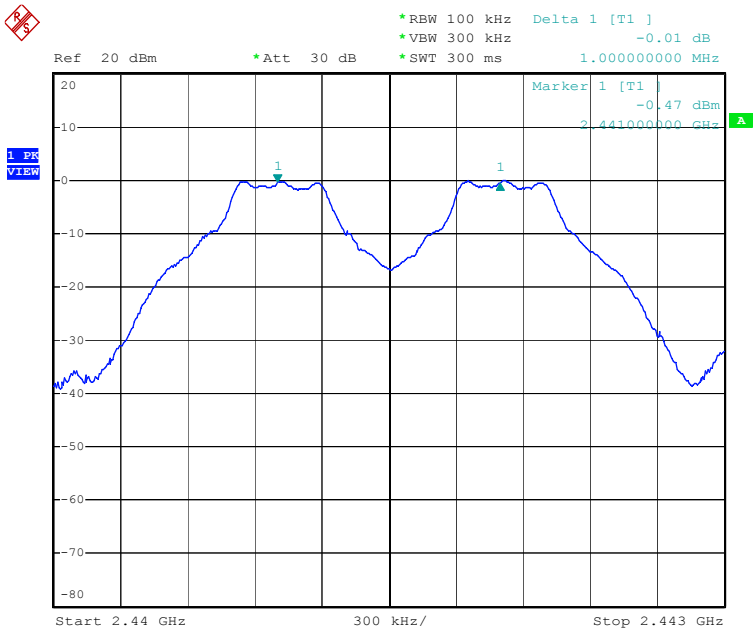
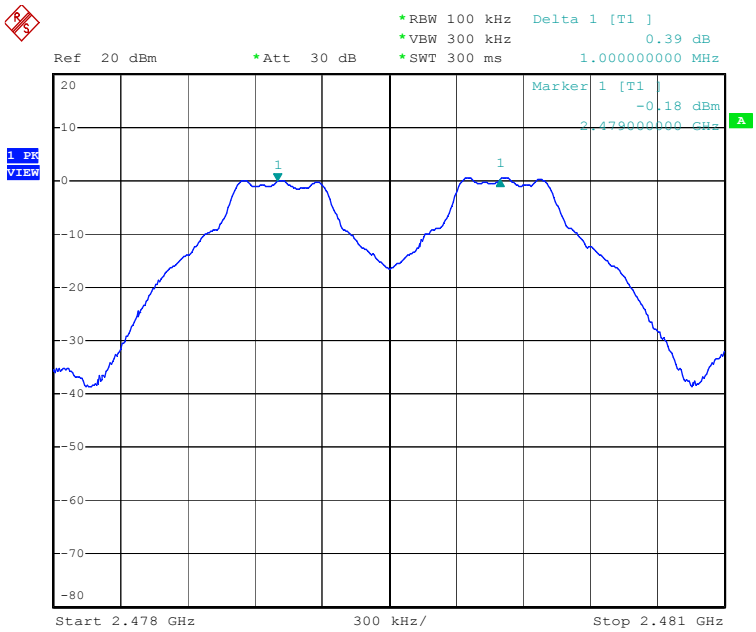
Modulation Type: GFSK (Channel 39) :



Date: 18.MAR.2005 07:42:13

Modulation Type: GFSK (Channel 78)：



Date: 18.MAR.2005 07:43:31

5.3. Test of Number of Hopping Frequency

5.3.1. Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

5.3.2. Measuring Instruments

Item 18 of the table is on section 6.

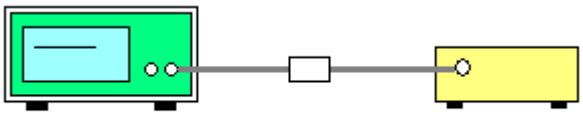
5.3.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz ~ 2480 MHz
  Span Frequency : > Operation frequency range
  RB : 100 kHz
  VB : 100 kHz

5.3.4. Test Procedures

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.
4. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 75 non-overlapping channels.
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.3.5. Test Setup Layout



5.3.6. Test Criteria

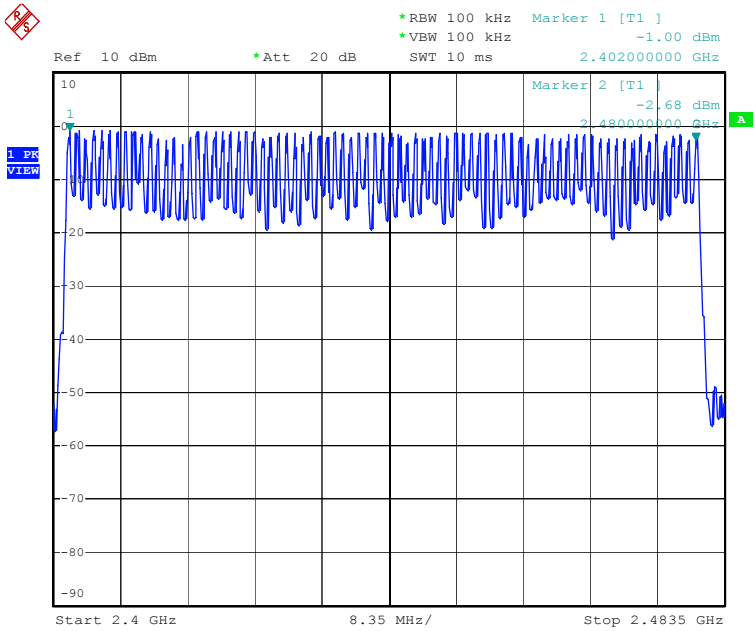
All test results complied with the requirements of Section 15.247(b)(1).

5.3.7. Test Result

- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Modulation Type	Channel No.	Frequency (MHz)	Number of Hopping Ch. (Channels)	Min. Limit (Channels)
GFSK	00 ~ 78	2402 MHz ~ 2480 MHz	79	75

Modulation Type: GFSK (Channel 00 ~ Channel 78) :



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5.4. Test of Dwell Time of Each Frequency

5.4.1. Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

5.4.2. Measuring Instruments

Item 18 of the table is on section 6.

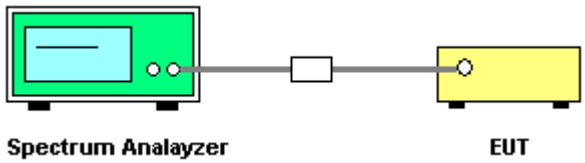
5.4.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2441 MHz / 2480 MHz
  Span Frequency : 0MHz
  RB : 1 MHz
  VB : 1 MHz
  Detector : Peak
  Trigger : Video
  Sweep Time : > One pulse time

5.4.4. T Test Procedures and Test Instruments Setting

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 1000kHz and VBW to 1000kHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is more than once pulse time.
4. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
5. Set the EUT for DH5, DH3 and DH1 packet transmitting.
6. Measure the maximum time duration of one single pulse.
7. DH5 Packet permit maximum 3.37 hops per second in each channel. So, the dwell time is the time duration of the pulse times 106.6 within 31.6 seconds.
8. DH3 Packet permit maximum 5.06 hops per second in each channel. So, the dwell time is the time duration of the pulse times 160 within 31.6 seconds.
9. DH1 Packet permit maximum 10.12 hops per second in each channel. So, the dwell time is the time duration of the pulse times 320 within 31.6 seconds.

5.4.5. Test Setup Layout



5.4.6. Test Criteria

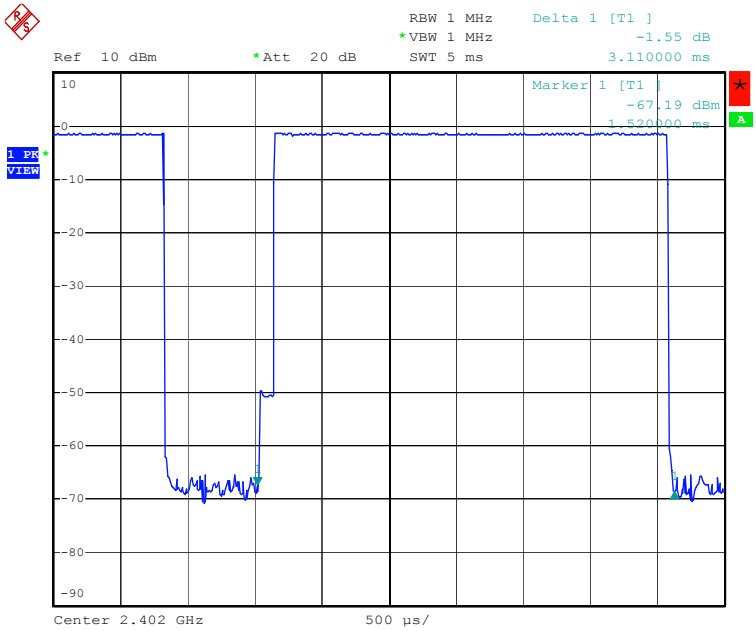
All test results complied with the requirements of Section 15.247(a)(1)(iii). Measurement Uncertainty is $1x10^{-5}$.

5.4.7. Test Result

- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)
DH5	2402 MHz	3.11	0.3317	0.4
DH3	2402 MHz	1.85	0.2960	0.4
DH1	2402 MHz	0.58	0.1856	0.4
DH5	2441 MHz	3.11	0.3317	0.4
DH3	2441 MHz	1.85	0.2960	0.4
DH1	2441 MHz	0.58	0.1856	0.4
DH5	2480 MHz	3.11	0.3317	0.4
DH3	2480 MHz	1.85	0.2960	0.4
DH1	2480 MHz	0.58	0.1856	0.4

DH5 Modulation Type: GFSK (Channel 00)：



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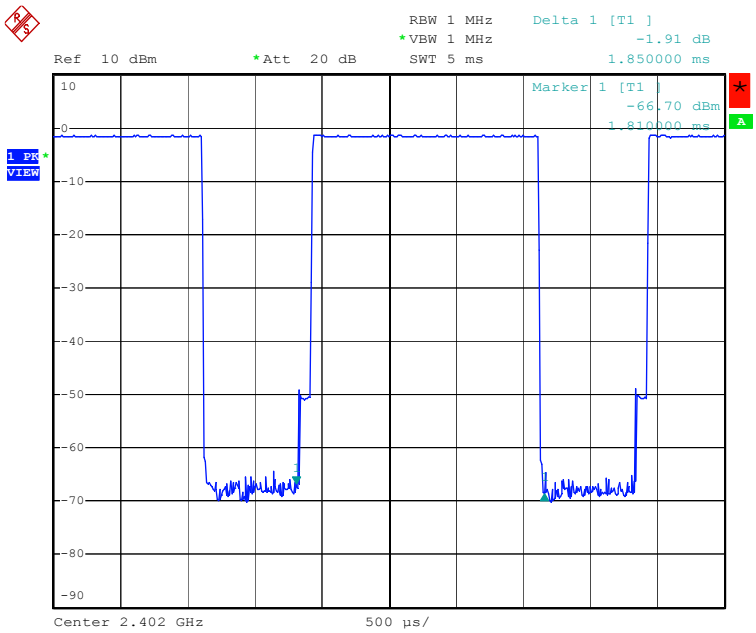
DH3 Modulation Type: GFSK (Channel 00)：



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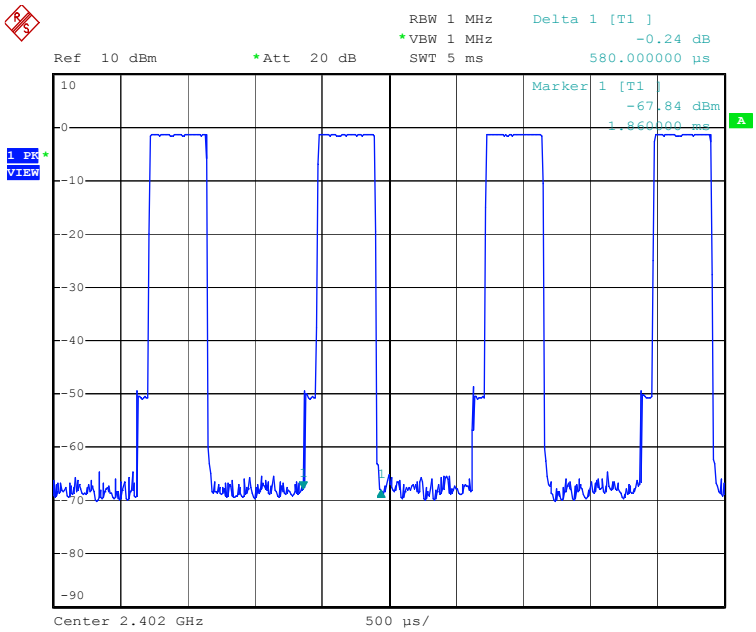
DH1 Modulation Type: GFSK (Channel 00)：



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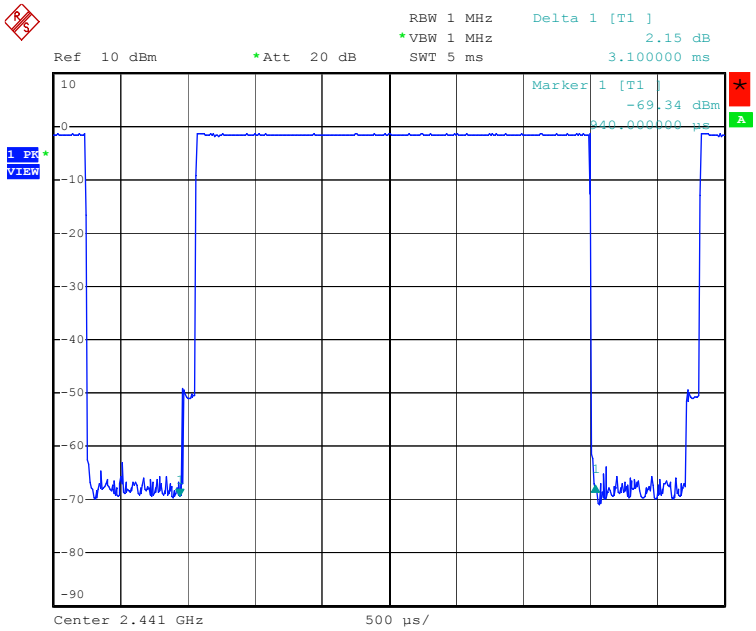
DH5 Modulation Type: GFSK (Channel 39)：



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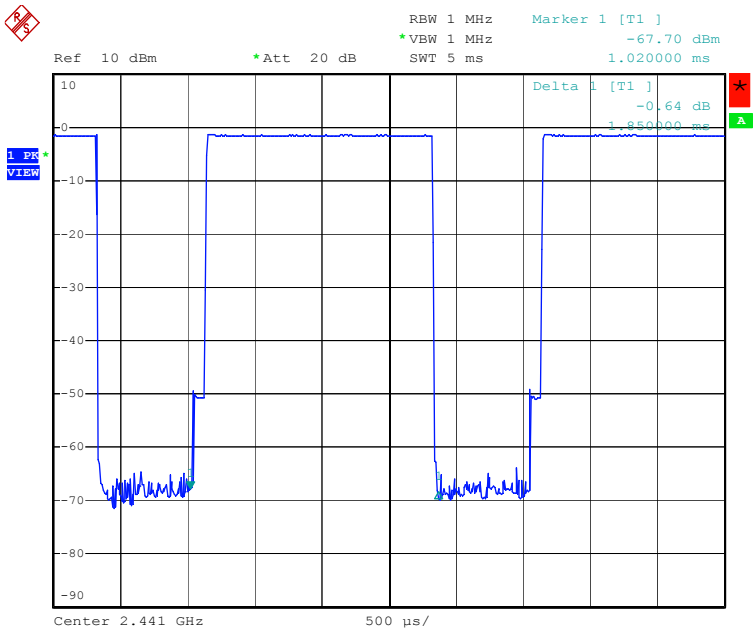
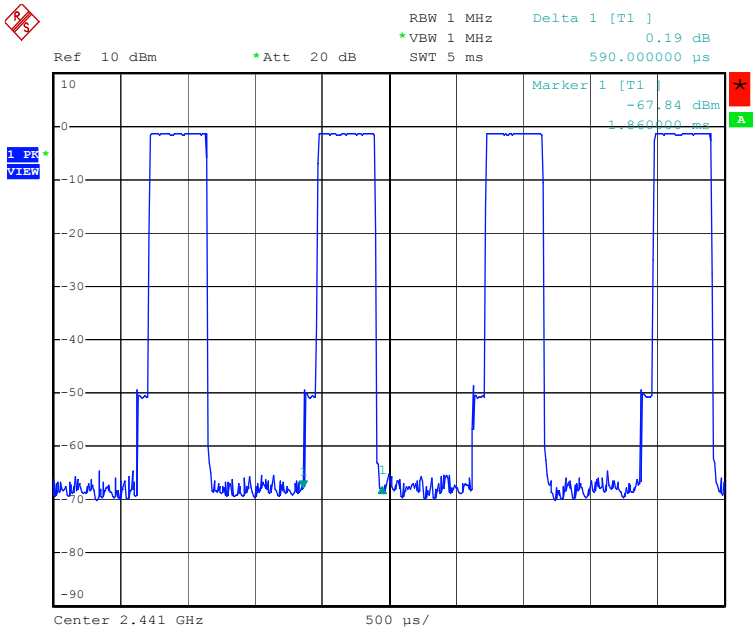
DH3 Modulation Type: GFSK (Channel 39)：



Date: 18.MAR.2005 08:04:33

DH1 Modulation Type: GFSK (Channel 39)：



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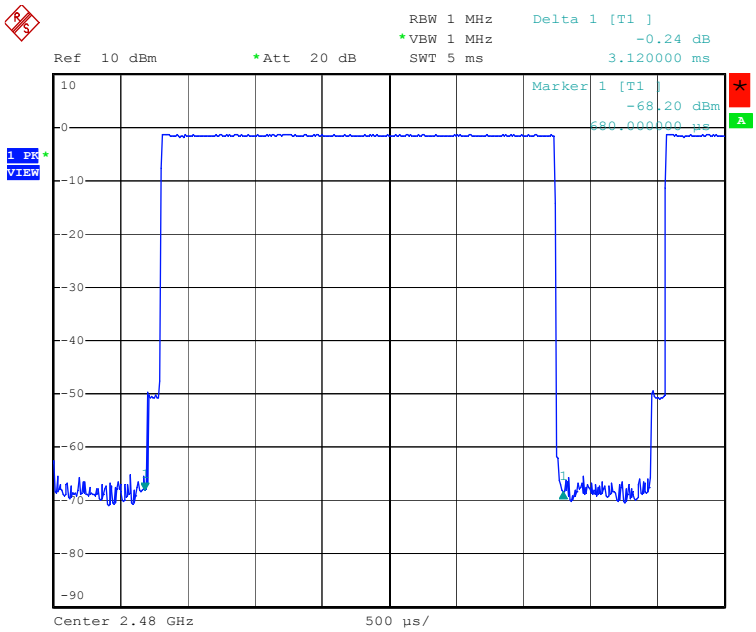
DH5 Modulation Type: GFSK (Channel 78)：



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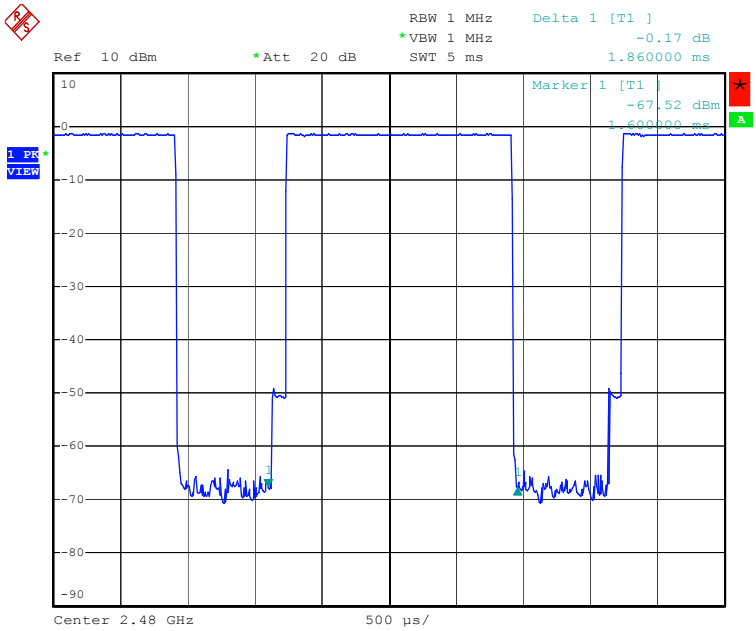
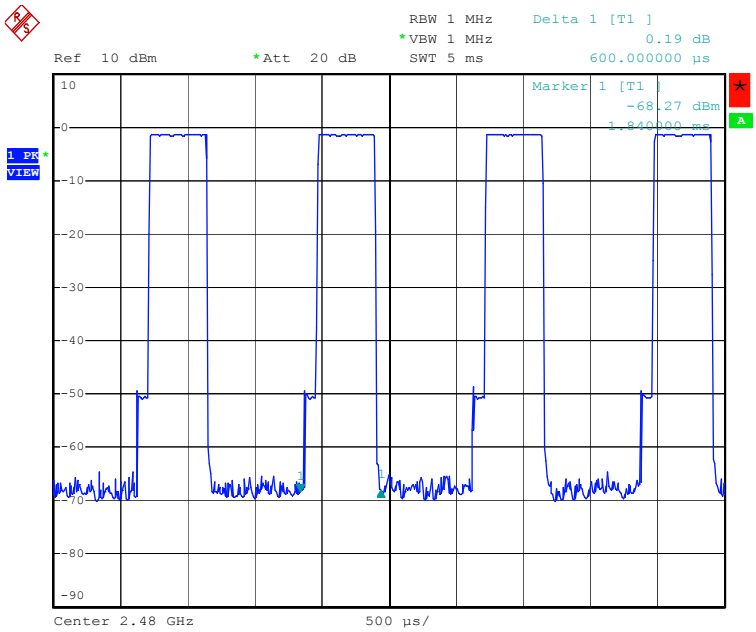
DH3 Modulation Type: GFSK (Channel 78)：



Date: 18.MAR.2005 08:04:56

DH1 Modulation Type: GFSK (Channel 78)：



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5.5. Maximum Peak Output Power

5.5.1. Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels and The maximum peak output power shall not exceed 1 watt.

5.5.2. Measuring Instruments

Item 19, 21 of the table is on section 6.

5.5.3. Test Procedures and Test Instruments Setting

1. The transmitter output was connected to the peak power meter and recorded the peak value.
2. The filter and attenuator has the same peak value instrument parameters.
3. Repeated the 1 for the middle and highest channel of the EUT.

5.5.4. Test Setup Layout

5.5.5. Test Criteria

All test results complied with the requirements of 15.247(b)(1). Measurement Uncertainty is 1.5dB.

5.5.6. Test Result of Conducted Peak Power

- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Modulation Type	Channel No.	Frequency (MHz)	Output Power (dBm)	Limits (dBm)
GFSK	00	2402 MHz	-0.19	30
GFSK	39	2441 MHz	0.04	30
GFSK	78	2480 MHz	-0.46	30

5.5.7. Test Result of EIRP Power

- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Antenna No.	Gain (dBi)	Modulation Type	Channel No.	Frequency (MHz)	Power (dBm)	Limits (dBm)
1	1.00	GFSK	00	2402 MHz	0.81	36
1	1.00	GFSK	39	2441 MHz	1.04	36
1	1.00	GFSK	78	2480 MHz	0.54	36

5.6. Test of Band Edges Emission

5.6.1. Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

5.6.2. Measuring Instruments

Item 6~17 of the table is on section 6 for radiated measurement.
Item 18 of the table is on section 6 for conducted measurement.

5.6.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30 (Conducted Measurement)
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2480 MHz
  Span Frequency : 100MHz
  RB : 100 kHz
  VB : 100 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

- Spectrum Analyzer : R&S FSP40 (Radiated Measurement)
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2480 MHz
  Span Frequency : 100MHz
  RB : 1 MHz for PK value / 1 MHz for AV value
  VB : 1 MHz for PK value / 10 Hz for AV value
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

5.6.4. Test Procedures

Conducted Measurement

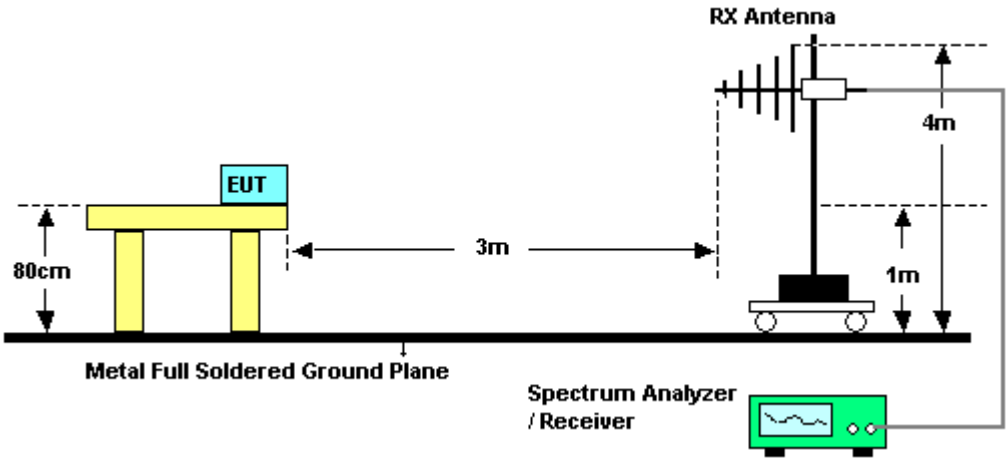
1. The transmitter is set to the lowest channel.
2. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.
3. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100MHz bandwidth from lower band edge. Then detector set to peak and max hold this trace.
4. The lowest band edges emission was measured and recorded.
5. The transmitter set to the highest channel and repeated 2~4.

Radiated Measurement

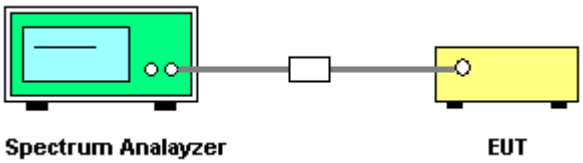
1. Configure the EUT according to ANSI C63.4.
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. For band edge emission, use 10Hz VBW and 1MHz RBW for reading under AV and use 1MHz VBW and 1 MHz RBW for reading under PK.

5.6.5. Test Setup

Radiated Method



Conducted Method



5.6.6. Test Criteria

All test results complied with the requirements of 15.247(d). Measurement Uncertainty is 2.26dB.

5.6.7. Test Result of Radiated Emission

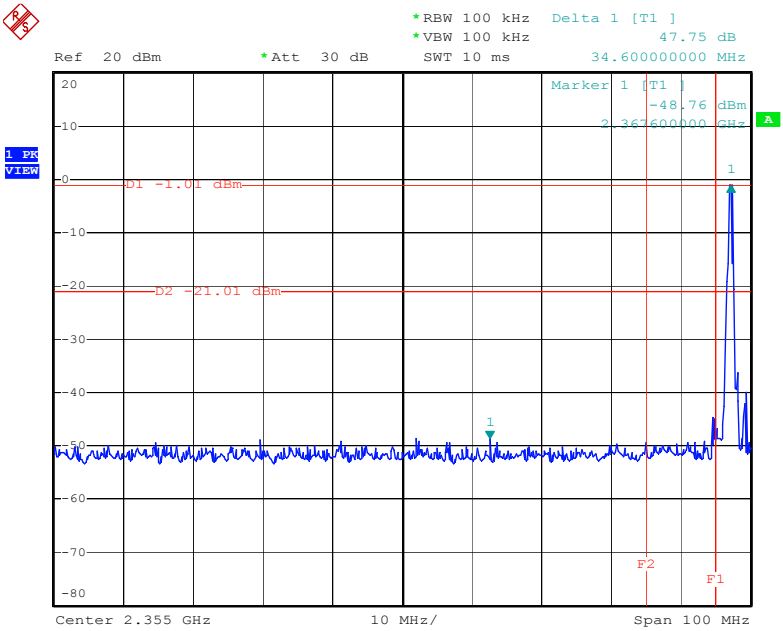
- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Leo Hung

Modulation Type	Test Channel	Freq. (MHz)	Level* (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Trace (PK/AV)
GFSK	00	2390.02	54.30	-19.70	74	PK
GFSK	00	2390.00	46.30	-7.70	54	AV
GFSK	78	2483.50	62.24	-11.76	74	PK
GFSK	78	2483.50	51.49	-2.51	54	AV

Level* : The max field strength in the restricted bands.

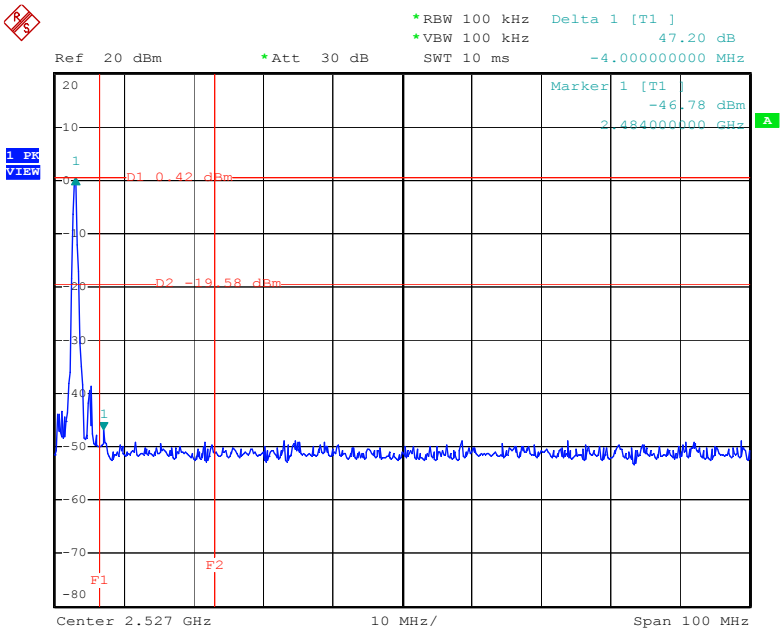
Test Result of Conducted Emission

Modulation Type: GFSK (Channel 00) :



Date: 22.MAR.2005 02:24:31

Modulation Type: GFSK (Channel 78) :



Date: 22.MAR.2005 02:21:17

5.7. Test of AC Power Line Conducted Emission

5.7.1. Applicable Standard

Section 15.207: For a Low-power Radio-frequency Device is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

5.7.2. Measuring Instruments

Please reference item 1~5 in chapter 6 for the instruments used for testing.

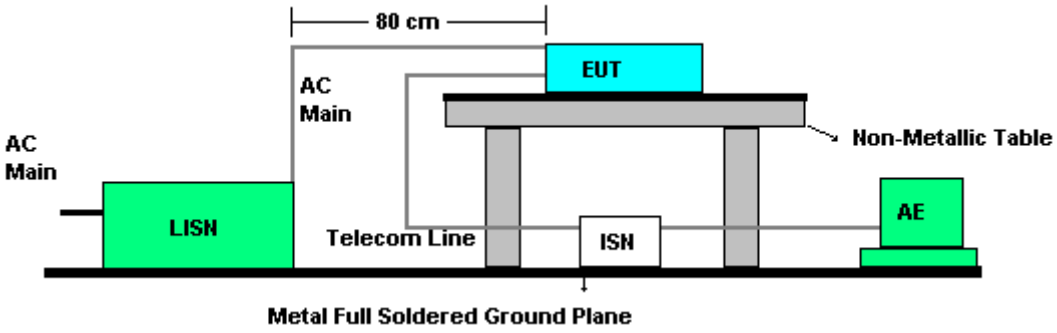
5.7.3. Description of Major Test Instruments Setting

- Test Receiver : R&S ESCS 30
  Attenuation : 10 dB
  Start Frequency : 0.15 MHz
  Stop Frequency : 30 MHz
  IF Bandwidth : 9 KHz

5.7.4. Test Procedures

1. Configure the EUT according to ANSI C63.4.
2. The EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN)
4. All the support units are connected to the other LISNs. The LISN should provides 50uH/50ohms coupling impedance.
5. The frequency range from 150 KHz to 30 MHz was searched.
6. Use the Channel & Power Controlling software to make the EUT working on selected channel and expected output power, then use the “H” Patter Generator software to make the supporting equipments stay on working condition.
7. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
8. The measurement has to be done between each power line and ground at the power terminal for each RF channel. Only one RF channel has to be investigated since this test is independent with the RF channel selection.

5.7.5. Test Setup Layout



5.7.6. Test Criteria

All test results complied with the requirements of 15.207. Measurement Uncertainty is 2.54dB.

5.7.7. Test Result of Conducted Emission for CH 78 / 2480 MHz

- Modulation Type: GFSK
- Temperature: 18°C
- Relative Humidity: 64%
- Test Engineer: Sky Wu

Line to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.2659610	44.95	-16.29	61.24	44.61	0.06	0.28	QP
2	0.2659610	34.45	-16.79	51.24	34.11	0.06	0.28	Average
3	0.3997440	43.05	-14.81	57.86	42.71	0.06	0.28	QP
4	0.3997440	29.75	-18.11	47.86	29.41	0.06	0.28	Average
5	0.6647840	41.22	-14.78	56.00	40.46	0.11	0.65	QP
6	0.6647840	29.33	-16.67	46.00	28.57	0.11	0.65	Average
7	0.9294890	39.25	-16.75	56.00	38.48	0.11	0.66	QP
8	0.9294890	28.61	-17.39	46.00	27.84	0.11	0.66	Average
9	2.273	14.57	-41.43	56.00	14.21	0.13	0.23	QP
10	2.273	5.20	-40.80	46.00	4.84	0.13	0.23	Average
11	3.191	7.34	-38.66	46.00	6.89	0.18	0.27	Average
12	3.191	19.30	-36.70	56.00	18.85	0.18	0.27	QP

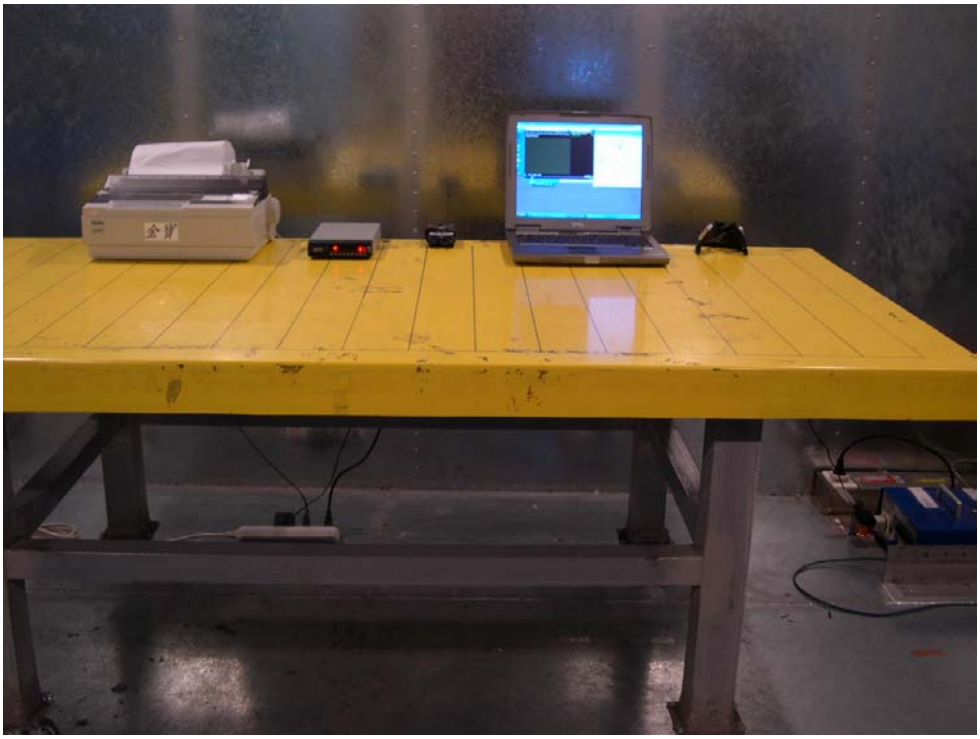
Neutral to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.2644240	45.39	-15.90	61.29	45.00	0.11	0.28	QP
2	@0.2644240	42.92	-8.37	51.29	42.53	0.11	0.28	Average
3	0.3997440	38.50	-9.36	47.86	38.11	0.11	0.28	Average
4	0.3997440	43.24	-14.62	57.86	42.85	0.11	0.28	QP
5	@0.6647840	38.40	-7.60	46.00	37.52	0.23	0.65	Average
6	0.6647840	42.16	-13.84	56.00	41.28	0.23	0.65	QP
7	0.7975740	42.98	-13.02	56.00	42.05	0.23	0.70	QP
8	0.7975740	37.43	-18.57	56.00	36.50	0.23	0.70	QP
9	0.9331400	36.65	-19.35	56.00	35.76	0.23	0.66	QP
10	0.9331400	34.86	-11.14	46.00	33.97	0.23	0.66	Average
11	1.461	38.12	-17.88	56.00	37.48	0.23	0.41	QP
12	1.461	32.77	-13.23	46.00	32.13	0.23	0.41	Average

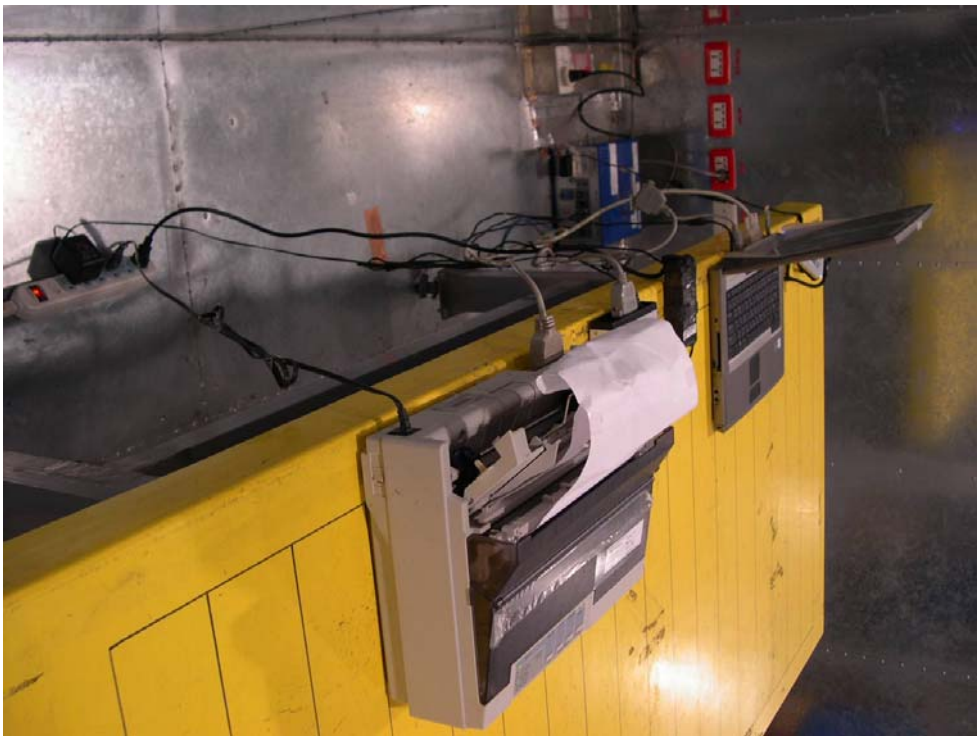
Note:
Corrected Reading: Probe (LISN / ISN) Factor + Cable Loss + Read Level = Level.

5.7.8. Photographs of Conducted Emission Test Configuration

FRONT VIEW



REAR VIEW



5.8. Test of Spurious Radiated Emission

5.8.1. Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

5.8.2. Measuring Instruments

Please reference item 1~17 in chapter 6 for the instruments used for testing.

5.8.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP40
  Attenuation : Auto
  Start Frequency : 1000 MHz
  Stop Frequency : 10th carrier harmonic
  RB / VB : 1 MHz / 1MHz for Peak
  RB / VB : 1 MHz / 10Hz for Average

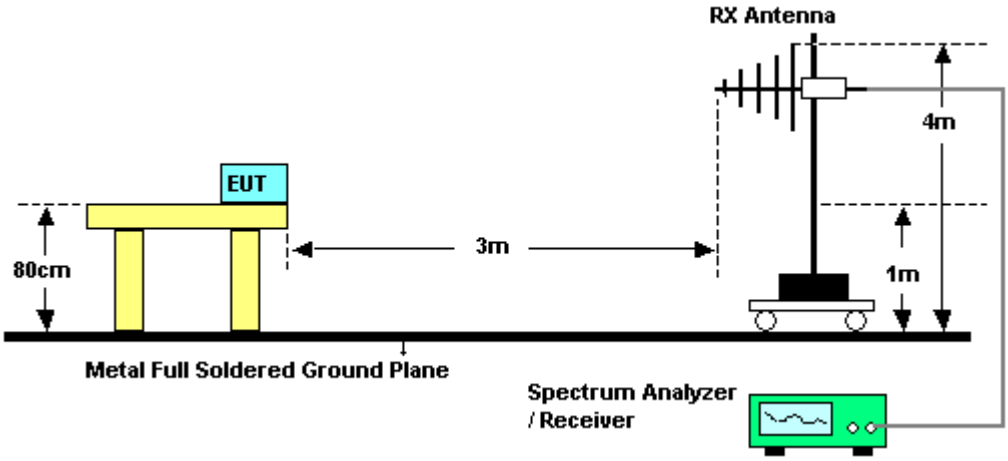
- Test Receiver : R&S ESCS 30
  Attenuation : Auto
  Start Frequency : 30 MHz
  Stop Frequency : 1000 MHz
  RB : 120 KHz for QP or PK

5.8.4. Test Procedures

1. Configure the EUT according to ANSI C63.4.
2. The EUT was placed on the top of the turntable 0.8 meter above ground.
3. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
4. Power on the EUT and all the supporting units.
5. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
7. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
8. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
9. For emission above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.

10. If the emission level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz and average method for above the 1GHz. the reported.
11. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB higher than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

5.8.5. Test Setup Layout



5.8.6. Test Criteria

All test results complied with the requirements of 15.247(d). Measurement Uncertainty is 2.26dB.

5.8.7. Test Results for CH 78 / 2480 MHz (for emission below 1GHz)

- Modulation Type: GFSK
- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Ming Tai, Kao

(A) Polarization: Horizontal

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	299.660	33.72	-12.28	46.00	13.00	1.37	30.16	49.51	HORIZONTAL	Peak
2	331.670	34.37	-11.63	46.00	13.90	1.44	30.51	49.55	HORIZONTAL	Peak
3 !	400.540	42.05	-3.95	46.00	15.94	1.59	30.35	54.87	HORIZONTAL	Peak
4	431.580	31.64	-14.36	46.00	16.38	1.64	30.42	44.05	HORIZONTAL	Peak
5	665.350	37.35	-8.65	46.00	18.91	2.06	30.35	46.74	HORIZONTAL	Peak
6	835.100	39.32	-6.68	46.00	20.29	2.33	30.00	46.71	HORIZONTAL	Peak

(B) Polarization: Vertical

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	106.630	27.79	-15.71	43.50	11.29	0.83	30.08	45.74	VERTICAL	Peak
2	388.900	27.69	-18.31	46.00	15.37	1.56	30.43	41.19	VERTICAL	Peak
3	454.860	31.10	-14.90	46.00	16.50	1.69	30.47	43.38	VERTICAL	Peak
4	501.420	31.03	-14.97	46.00	17.42	1.77	30.52	42.36	VERTICAL	Peak
5	668.260	33.88	-12.12	46.00	18.91	2.06	30.36	43.27	VERTICAL	Peak
6	832.190	35.68	-10.32	46.00	20.30	2.32	30.01	43.07	VERTICAL	Peak

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

5.8.8. Test Results for CH 00 / 2402 MHz (for emission above 1GHz)

- Modulation Type: GFSK
- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Ming Tai, Kao

(A) Polarization: Horizontal

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	1601.990	51.18	-22.82	74.00	25.58	1.43	35.73	59.90	HORIZONTAL	PEAK
2 !	1602.010	49.24	-4.76	54.00	25.58	1.43	35.73	57.96	HORIZONTAL	AVERAGE
3	4804.000	54.67	-19.33	74.00	33.18	3.20	37.59	55.87	HORIZONTAL	PEAK
4	4804.000	38.40	-15.60	54.00	33.18	3.20	37.59	39.60	HORIZONTAL	AVERAGE

(B) Polarization: Vertical

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	1601.970	53.61	-20.39	74.00	25.58	1.43	35.73	62.33	VERTICAL	PEAK
2 !	1602.010	51.72	-2.28	54.00	25.58	1.43	35.73	60.43	VERTICAL	AVERAGE
3	4804.300	55.14	-18.86	74.00	33.18	3.20	37.59	56.34	VERTICAL	PEAK
4	4804.300	40.20	-13.80	54.00	33.18	3.20	37.59	41.40	VERTICAL	AVERAGE

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

5.8.9. Test Results for CH 39 / 2441 MHz (for emission above 1GHz)

- Modulation Type: GFSK
- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Ming Tai, Kao

(A) Polarization: Horizontal

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1 !	1628.020	50.24	-3.76	54.00	25.71	1.46	35.74	58.81	HORIZONTAL	AVERAGE
2	1628.020	51.91	-22.09	74.00	25.71	1.46	35.74	60.48	HORIZONTAL	PEAK
3	4882.030	39.92	-14.08	54.00	33.33	3.23	37.65	41.00	HORIZONTAL	AVERAGE
4	4882.030	55.04	-18.96	74.00	33.33	3.23	37.65	56.12	HORIZONTAL	PEAK

(B) Polarization: Vertical

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	1628.000	51.74	-22.26	74.00	25.71	1.46	35.74	60.31	VERTICAL	PEAK
2 !	1628.000	49.73	-4.27	54.00	25.71	1.46	35.74	58.30	VERTICAL	AVERAGE
3	4881.970	40.72	-13.28	54.00	33.33	3.23	37.65	41.80	VERTICAL	AVERAGE
4	4881.970	56.37	-17.63	74.00	33.33	3.23	37.65	57.45	VERTICAL	PEAK

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

5.8.10. Test Results for CH 78 / 2480 MHz (for emission above 1GHz)

- Modulation Type: GFSK
- Temperature: 18°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 46.40%
- Test Engineer: Ming Tai, Kao

(A) Polarization: Horizontal

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1 !	1654.020	48.73	-5.27	54.00	25.77	1.50	35.75	57.22	HORIZONTAL	AVERAGE
2	1654.100	50.74	-23.26	74.00	25.77	1.50	35.75	59.23	HORIZONTAL	PEAK
3	4960.050	41.20	-12.80	54.00	33.52	3.26	37.71	42.12	HORIZONTAL	AVERAGE
4	4960.320	57.79	-16.21	74.00	33.52	3.26	37.71	58.71	HORIZONTAL	PEAK
5	9919.800	53.65	-20.35	74.00	38.80	4.84	36.38	46.38	HORIZONTAL	PEAK
6	9919.920	39.64	-14.36	54.00	38.80	4.84	36.38	32.37	HORIZONTAL	AVERAGE

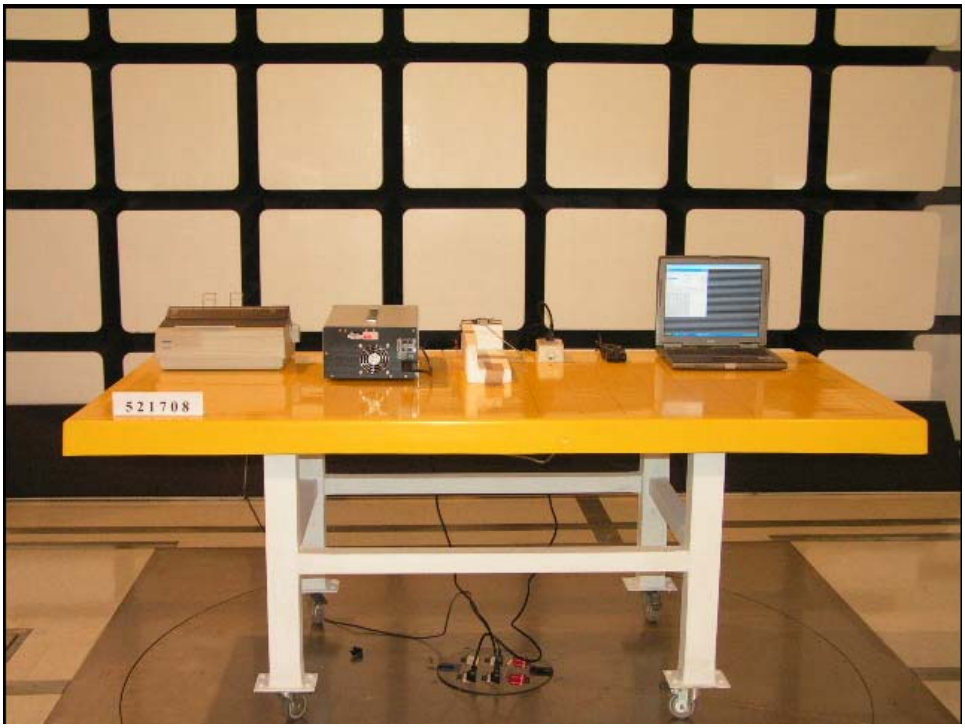
(B) Polarization: Vertical

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1 !	1654.020	50.32	-3.68	54.00	25.77	1.50	35.75	58.80	VERTICAL	AVERAGE
2	1654.040	51.99	-22.01	74.00	25.77	1.50	35.75	60.47	VERTICAL	PEAK
3	4960.050	41.86	-12.14	54.00	33.52	3.26	37.71	42.78	VERTICAL	AVERAGE
4	4960.050	58.13	-15.87	74.00	33.52	3.26	37.71	59.05	VERTICAL	PEAK
5	9919.250	53.19	-20.81	74.00	38.80	4.84	36.38	45.92	VERTICAL	PEAK
6	9920.010	39.23	-14.77	54.00	38.80	4.84	36.38	31.96	VERTICAL	AVERAGE

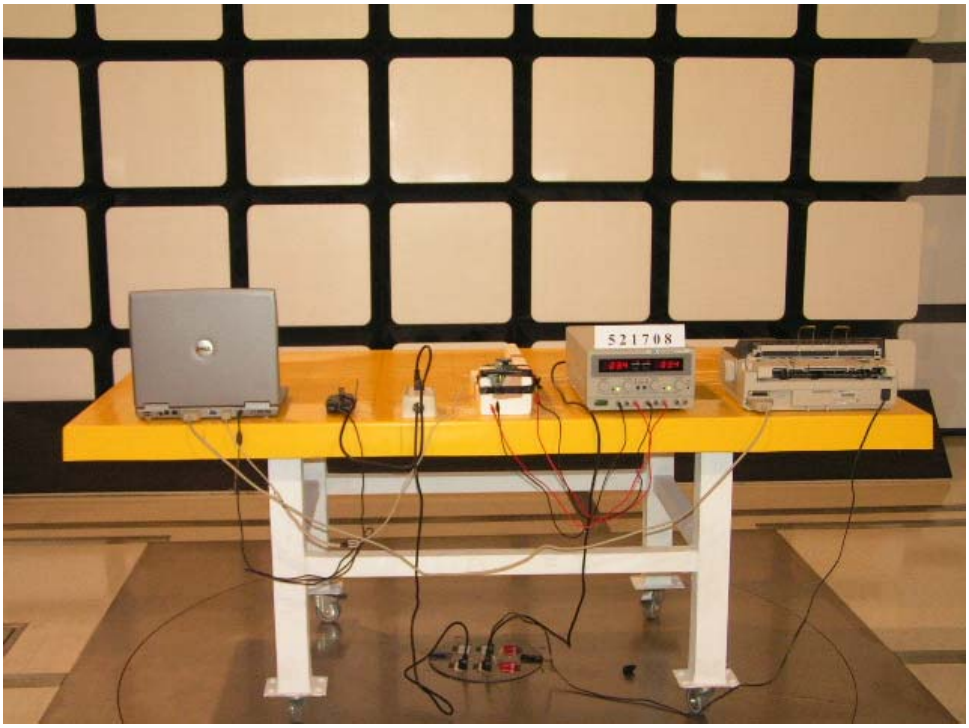
Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

5.8.11. Photographs of Radiated Emission Test Configuration

FRONT VIEW



REAR VIEW



5.9. Antenna Requirements

5.9.1. Standard Applicable

Section 15.203:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Section 3.10.1(4):
The limitation on type of antenna specified the requirements of 2.2 is not.(Only for DGT)

Section 15.247(b)/(c):
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.9.2. Antenna Connected Construction

There is no antenna connector for printed antenna.

5.9.3. Antenna Gain

All antenna gain of EUT is less than 6dBi. Therefore peak conducted power limit shall not be degraded any more. Antenna report of manufacturer will have more detail antenna gain or antenna pattern.

5.9.4. Test Criteria

All test results complied with the requirements of 15.203/15.247(b)/(c).

6. List of Measuring Equipments Used

Items	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
1	EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	Feb. 15, 2005	Conduction (CO04-HY)
2	LISN	MessTec	NNB-2/16Z	2001/004	9kHz – 30MHz	Jun. 09, 2004	Conduction (CO04-HY)
3	LISN (Support Unit)	MessTec	NNB-2/16Z	99041	9kHz – 30MHz	Apr. 27, 2004	Conduction (CO04-HY)
4	EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	Conduction (CO04-HY)
5	RF Cable-CON	UTIFLEX	3102-26886-4	CB044	9kHz – 30MHz	Apr. 21, 2004	Conduction (CO04-HY)
6	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2004	Radiation (03CH03-HY)
7	Spectrum analyzer	R&S	FSP40	100004	9KHZ~40GHz	Aug. 31, 2004	Radiation (03CH03-HY)
8	Amplifier	SCHAFFNER	CPA9231A	18667	9KHz – 2GHz	Jan. 10, 2005	Radiation (03CH03-HY)
9	Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz –200MHz	Jul. 28, 2004	Radiation (03CH03-HY)
10	Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz -1GHz	Jul. 28, 2004	Radiation (03CH03-HY)
11	RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Feb. 22, 2005	Radiation (03CH03-HY)
12	Amplifier	MITEQ	AFS44	849984	100MHz~26.5GHz	Mar. 25, 2005	Radiation (03CH03-HY)
13	Horn Antenna	EMCO	3115	6741	1GHz – 18GHz	Apr. 07, 2004	Radiation (03CH03-HY)
14	Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
15	Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
16	Horn Antenna	Schwarzbeck	BBHA9170	154	18GHz~40GHz	Jun. 09, 2004	Radiation (03CH03-HY)
17	RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Dec.01, 2004	Radiation (03CH03-HY)

※ Calibration Interval of instruments listed above is one year.

Items	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
18	Spectrum analyzer	R&S	FSP7	838858/014	9KHZ~7GHZ	Sep. 02, 2004	Conducted (TH01-HY)
19	Power meter	R&S	NRVS	100444	DC~40GHz	Jun. 15, 2004	Conducted (TH01-HY)
20	Power sensor	R&S	NRV-Z55	100049	DC~40GHz	Jun. 15, 2004	Conducted (TH01-HY)
21	Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	Jun. 15, 2004	Conducted (TH01-HY)
22	AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	Jun. 16, 2004	Conducted (TH01-HY)
23	AC power source	G.W.	GPC-6030D	C671845	DC 1V~60V	Nov. 05, 2004	Conducted (TH01-HY)
24	Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Sep. 30, 2004	Conducted (TH01-HY)
25	RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz~7GHz	Jan. 01, 2005	Conducted (TH01-HY)
26	RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz~1GHz	Jan. 01, 2005	Conducted (TH01-HY)

※ Calibration Interval of instruments listed above is one year.

7. Company Profile

SPORTON Lab. was established in 1986 with one shielded room: the first private EMI test facility, offering local manufacturers an alternative EMI test familial apart from ERSO. In 1988, one 3M and 10M/3M open area test site were setup and also obtained official accreditation from FCC, VCCI and NEMKO. In 1993, a Safety laboratory was founded and obtained accreditation from UL of USA, CSA of Canada and TUV (Rhineland & PS) of Germany. In 1995, one EMC lab, including EMI and EMS test facilities was setup. In 1997, SPORTON Group has provided financial expense to relocate the headquarter to Orient Scientific Park in Taipei Hsien to offer more comprehensive, more qualified and better service to local suppliers and manufactures. In 1999, Safety Group and Component Group were setup. In 2001, SPORTON has established 3M/10M chamber in Hwa Ya Technology Park.

7.1. Certificate of Accreditation

Taiwan	BSMI, CNLA, DGT
USA	FCC, NVLAP, UL
EU	Nemko, TUV
Japan	VCCI
Canada	Industry Canada

7.2. Test Location

SHIJR	ADD：	6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C.
	TEL：	02-2696-2468
	FAX：	02-2696-2255
HWA YA	ADD：	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
	TEL：	03-327-3456
	FAX：	03-318-0055
LINKOU	ADD：	No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C
	TEL：	02-2601-1640
	FAX：	02-2601-1695
DUNGHU	ADD：	No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C.
	TEL：	02-2631-4739
	FAX：	02-2631-9740
JUNGHE	ADD：	7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C.
	TEL：	02-8227-2020
	FAX：	02-8227-2626
NEIHU	ADD：	4Fl., No. 339, Hsin Hu 2nd Rd., Taipei 114, Taiwan, R.O.C.
	TEL：	02-2794-8886
	FAX：	02-2794-9777

8. CNLA Certificate of Accreditation

Test Lab.	:	Sporton International Inc.
Accreditation Number	:	1190
Originally Accredited	:	2003/12/15
Effective Period	:	2003/12/15~2006/12/14
Accredited Scope	:	47 CFR FCC Part 15 Subpart C (9kHz~40GHz)

Taiwan Accreditation Foundation
Chinese National Laboratory Accreditation
Certificate of Accreditation

Accreditation Criteria:	ISO 17025
Accreditation Number:	1190
Organization/Laboratory:	EMC & Wireless Communications Laboratory,Sporton International Inc.
Originally Accredited:	December 15, 2003
Effective Period:	December 15, 2003 To December 14, 2006
Accredited Scope:	Electrical Testing Field, 7 items, details shown in the following pages.
Specific Accreditation Program:	Recognition and Approval of Designated Laboratory for Commodities Inspection

President, Taiwan Accreditation Foundation
Date:July 19, 2004

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