



FCC/IC - TEST REPORT

Report Number	:	68.950.15.185.01	Date of Issue:	<u>July 11, 2015</u>
Model	:	SPE101		
Product Type	:	Coolest Outdoor Bluetooth Speaker		
Applicant	:	Coolest LLC		
Address	:	1355 NW Everett St. Suite 100 Portland, Oregon USA		
Production Facility	:	Charter Media (Dongguan) Co., Ltd.		
Address	:	Dabandi Industrial Zone, Daning District, Humen Town, 523930		
		Dongguan City, Guangdong Province, PEOPLE'S REPUBLIC OF		
		CHINA		
Test Result	:	<input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative		
Total pages including Appendices	:	26		

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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P. R. China

Telephone: 86 755 8828 6998

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3 Description of the Equipment Under Test

Product:	Coolest Outdoor Bluetooth Speaker
Model no.:	SPE101
FCC ID:	2AEZT-SPE101
IC	20298-SPE101
Options and accessories:	Nil
Rating:	DC3.6V Supplied by NI-MH rechargeable battery DC5.0V Charged by the USB port
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Antenna Type:	PIFA
Antenna Gain:	3dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Bluetooth Speaker operated at 2.4GHz

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-247 Issue 1 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB558074 D01 DTS Meas Guidance v03r02 issued by FCC on July 05, 2014 and ANSI C63.10 (2009).

5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C			Pages	Test Result
Test Condition				
§15.207	RSS-GEN A7.2.4	Conducted emission AC power port	10	Pass
§15.247(b)(1)	RSS-247 Clause 5.4(2)	Conducted peak output power	13	Pass
§15.247(e)	RSS-247 Clause 5.2(2)	Power spectral density*	14	Pass
§15.247(a)(2)	RSS-247 Clause 5.2(1)	6dB bandwidth	15	Pass
§15.247(a)(1)	RSS-247 Clause 5.1(1)	20dB bandwidth and 99% Occupied Bandwidth	--	N/A
§15.247(a)(1)	RSS-247 Clause 5.1(2)	Carrier frequency separation	--	N/A
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(4)	Number of hopping frequencies	--	N/A
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(4)	Dwell Time	--	N/A
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	17	Pass
§15.247(d)	RSS-247 Clause 5.5	Band edge	21	Pass
§15.247(d) & §15.209 &	& RSSGEN 7.2.5	Spurious radiated emissions for transmitter and receiver	23	Pass
§15.203	RSSGEN 7.1.2	Antenna requirement	See note 1	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a patch antenna, which gain is 0dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AEZT-SPE101, IC: 20298-SPE101 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C, RSS 247 and RSS-Gen rules.

This report is for the BT 4.0 part.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed

- **Not** Performed

The Equipment Under Test

- **Fulfills** the general approval requirements.

- **Does not** fulfill the general approval requirements.

Sample Received Date: May 19, 2015

Testing Start Date: May 19, 2015

Testing End Date: June 10, 2015

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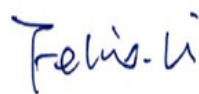
Reviewed by:

Prepared by:

Tested by:



Phoebe Hu
EMC Project Manager



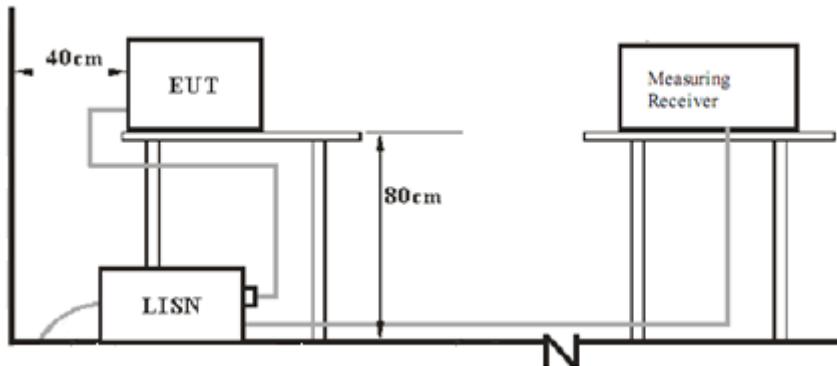
Felix Li
EMC Project Engineer



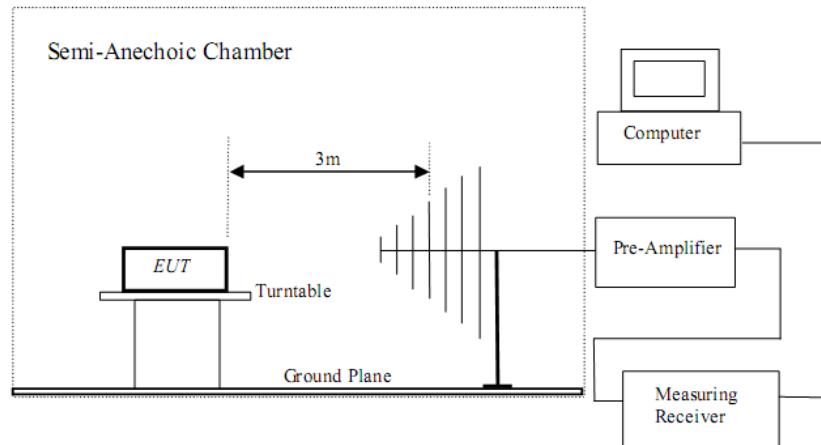
Leon Zhang
EMC Test Engineer

7 Test Setups

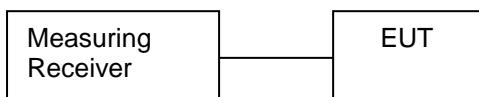
7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
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Test software: Blue test 3.0, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

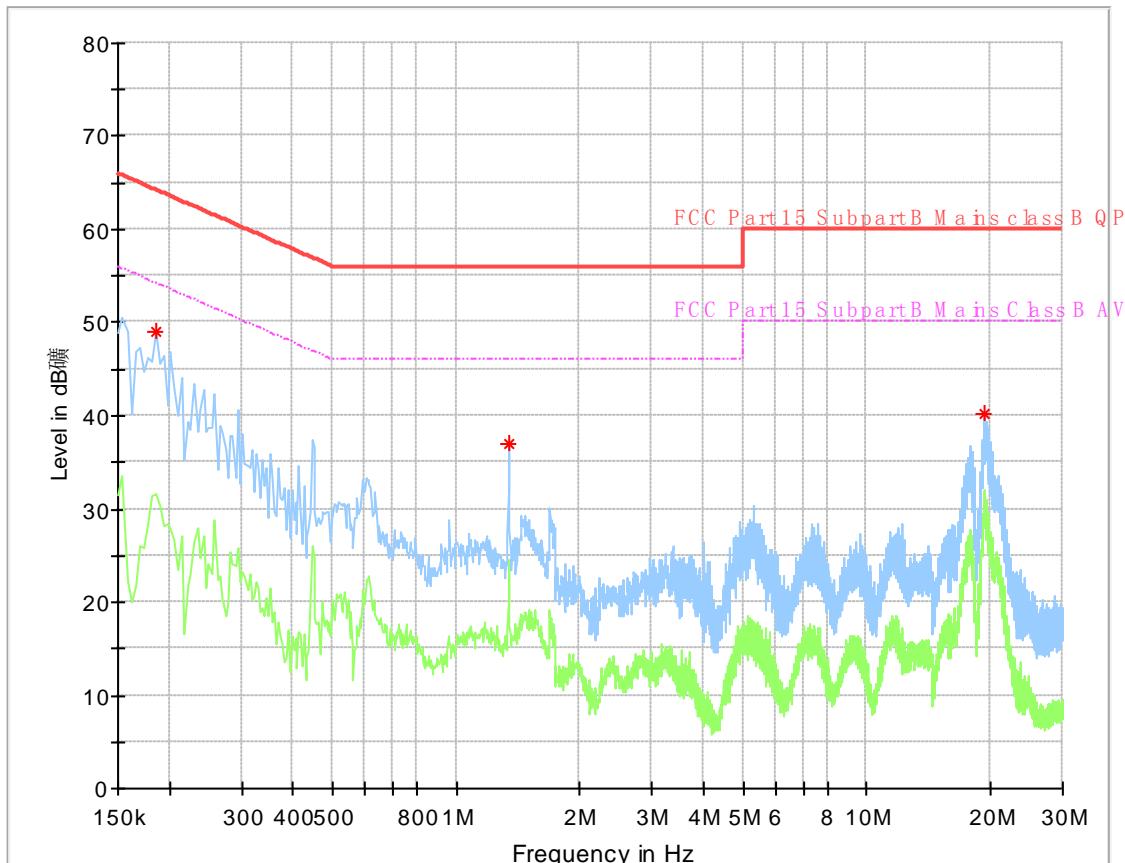
Limit

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

Conducted Emission

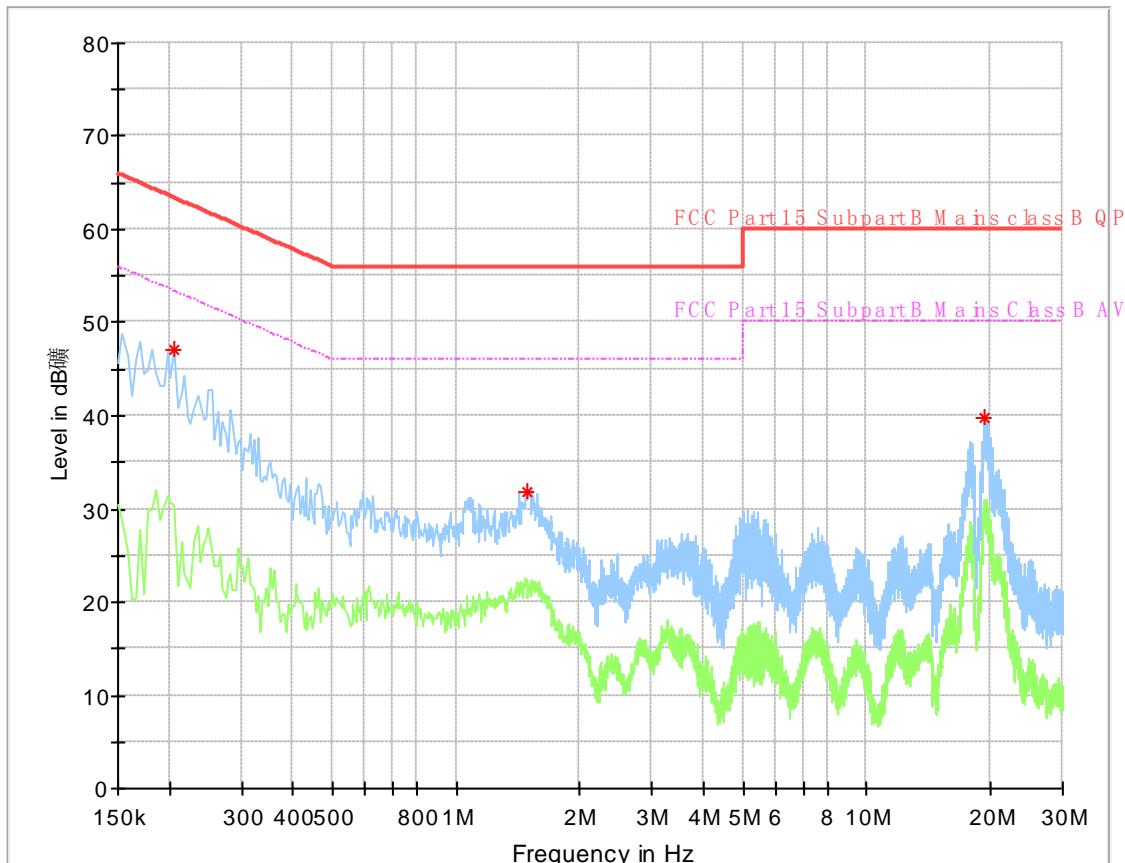
Product Type : Coolest Outdoor Bluetooth Speaker
 M/N : SPE101
 Operating Condition : Charging & TX
 Test Specification : Live
 Comment : AC 120V/60Hz



Frequency (MHz)	MaxPeak (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.186000	48.96	64.21	15.26	L1	9.7
1.342000	37.01	56.00	18.99	L1	9.8
19.450000	40.12	60.00	19.88	L1	10.2

Conducted Emission

Product Type : Coolest Outdoor Bluetooth Speaker
 M/N : SPE101
 Operating Condition : Charging & TX
 Test Specification : Neutral
 Comment : AC 120V/60Hz



Frequency (MHz)	MaxPeak (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.206000	47.10	63.37	16.27	N	9.8
1.490000	31.91	56.00	24.09	N	9.8
19.294000	39.71	60.00	20.29	N	10.1

9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured, $VBW \geq RBW$,
Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

Limits

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Conducted peak output power

BT 4.0 Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Conducted Peak		Result
	Output Power dBm		
Low channel 2402MHz	5.96		Pass
Middle channel 2440MHz	6.93		Pass
High channel 2480MHz	7.26		Pass

9.3 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency.
RBW=3kHz,VBW \geq 3RBW,Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed

Limit

Limit [dBm]

≤ 8

BT 4.0 Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Power spectral density	Limit dBm	Result
2402	-9.93	8	Pass
2440	-8.79	8	Pass
2480	-8.42	8	Pass

9.4 6 dB Bandwidth and 99% Occupied Bandwidth

Test Method

1. Use the following spectrum analyzer settings:
RBW=100K, VBW \geq 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be \geq 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

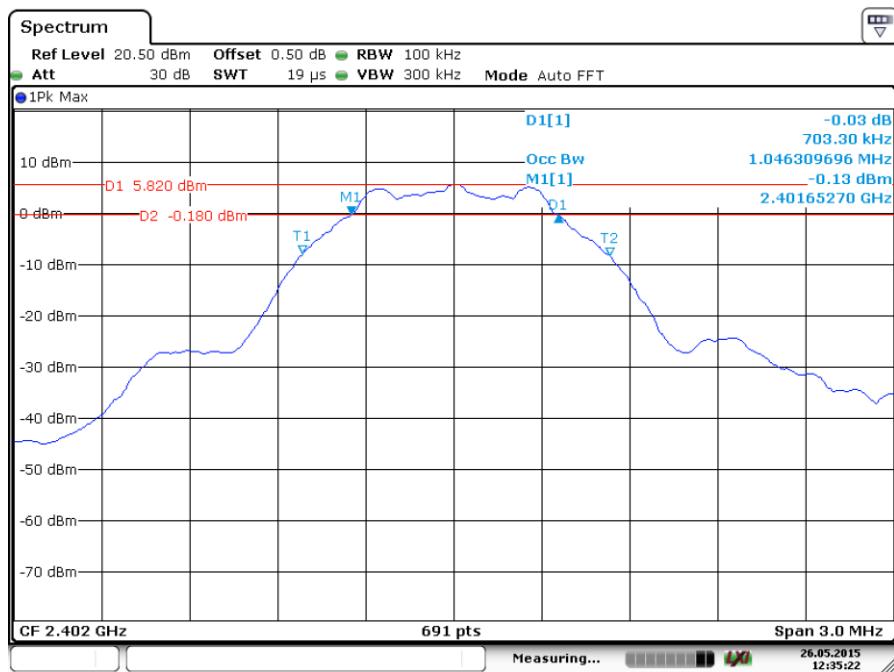
Limit [kHz]

≥ 500

BT 4.0 Bluetooth Mode GFSK modulation Test Result

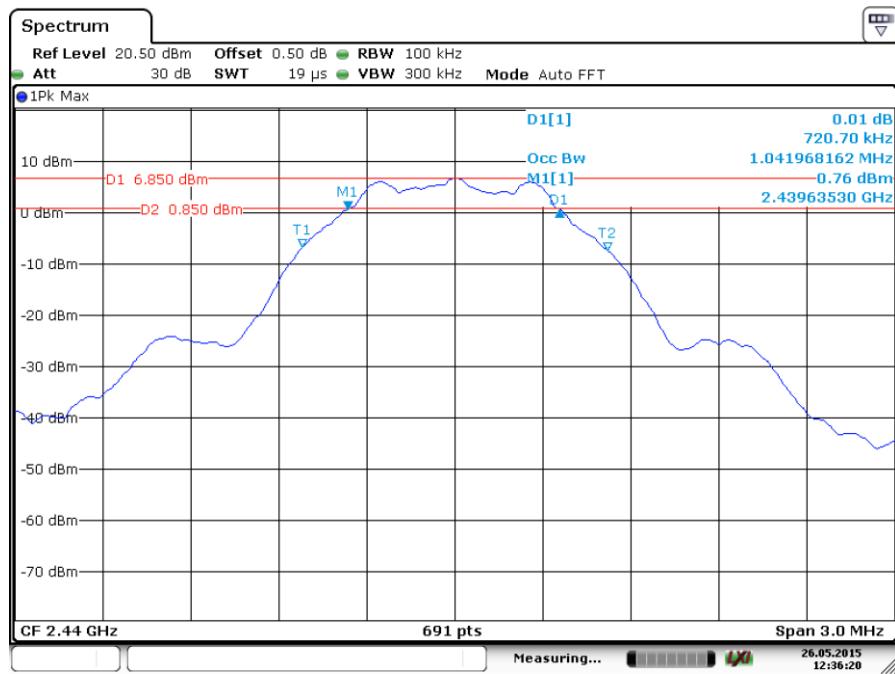
Frequency MHz	6 dB Bandwidth kHz	Limit kHz	Result
2402	703.3	500	Pass
2440	720.7	500	Pass
2480	716.4	500	Pass

6 dB Bandwidth

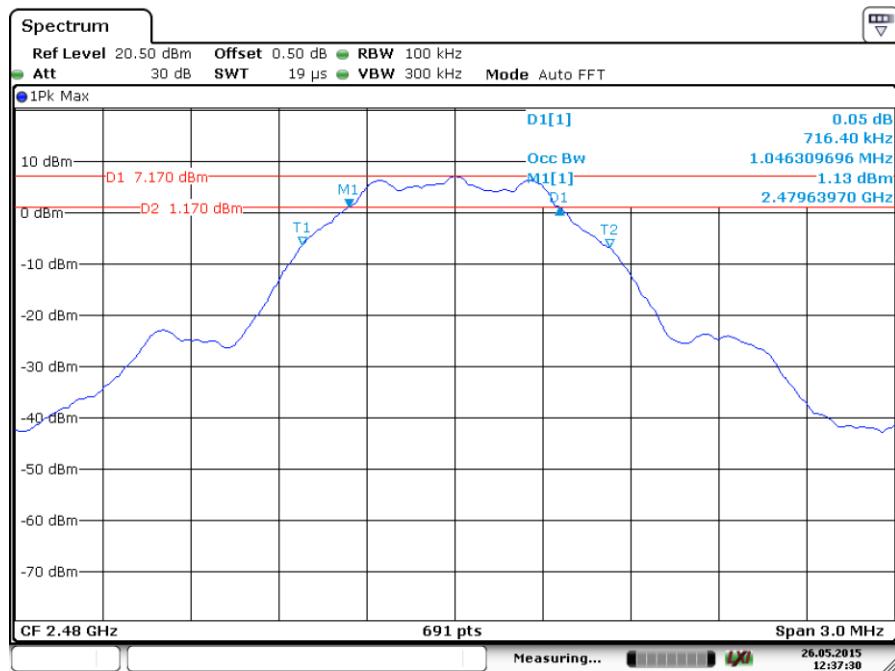


Date: 26.MAY.2015 12:35:23

6 dB Bandwidth



Date: 26.MAY.2015 12:36:19



Date: 26.MAY.2015 12:37:29

9.5 Spurious RF conducted emissions

Test Method

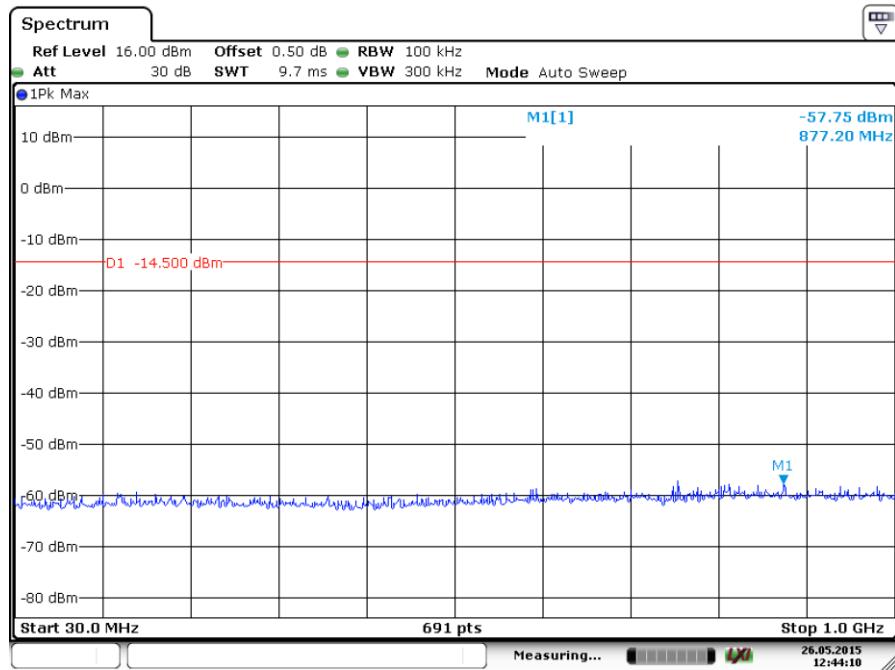
1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

Limit

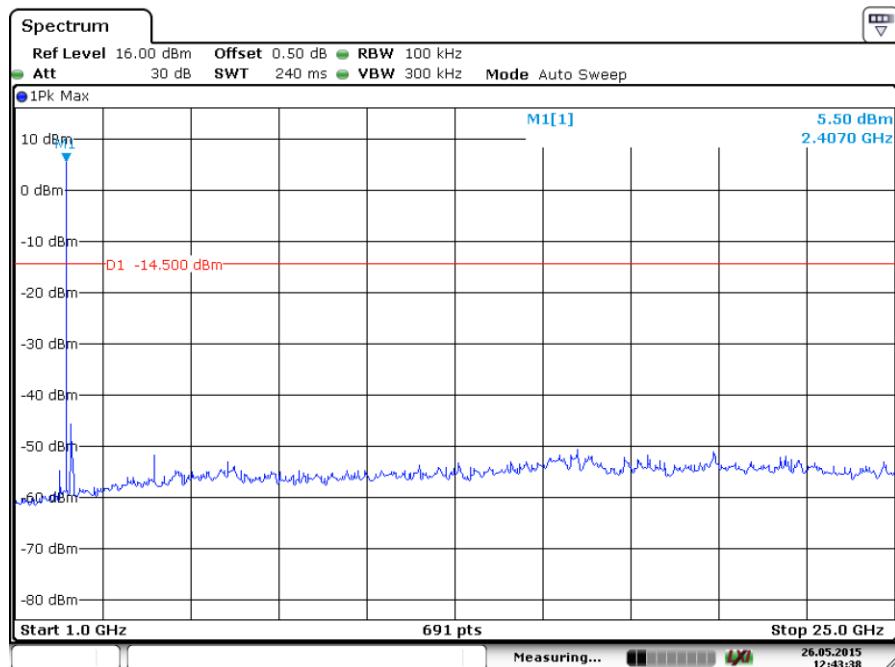
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

BT4.0 GFSK Modulation:
2402MHz



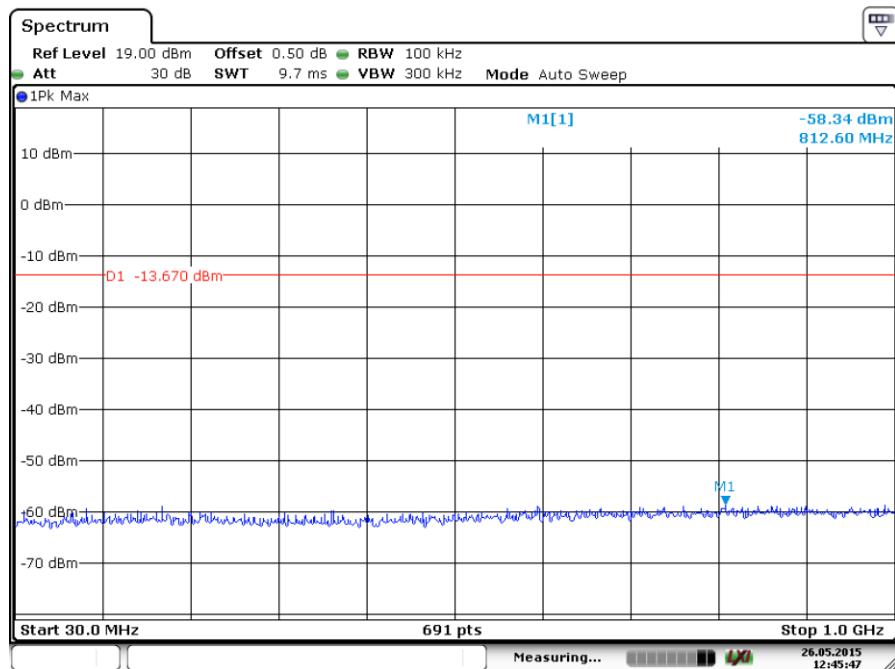
Date: 26.MAY.2015 12:44:10



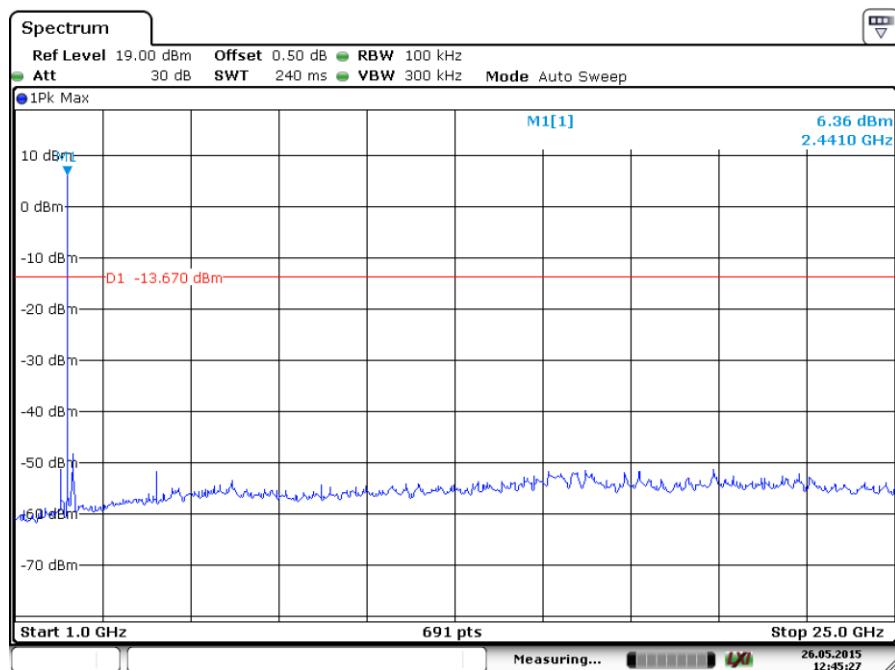
Date: 26.MAY.2015 12:43:37



2440MHz



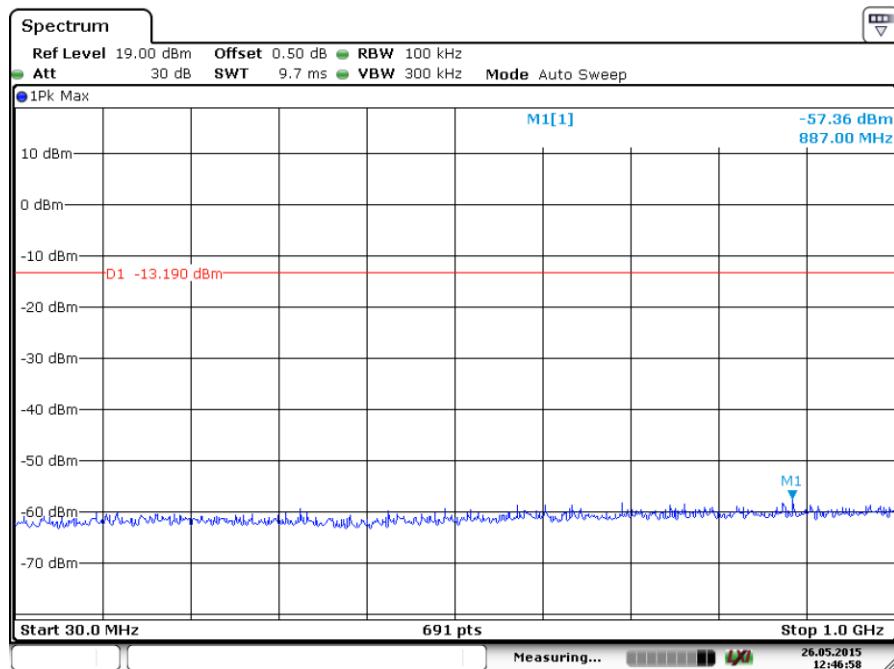
Date: 26.MAY.2015 12:45:47



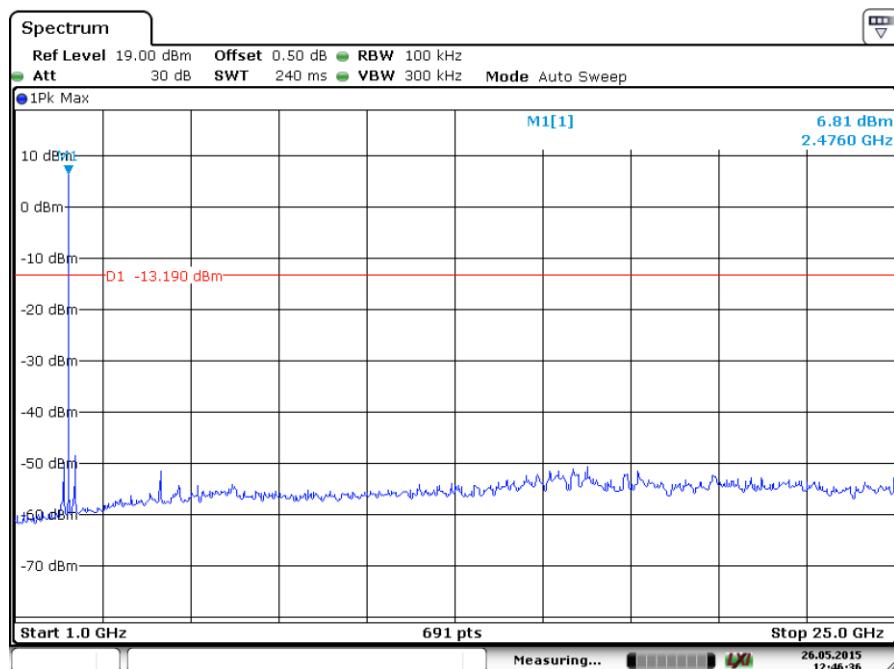
Date: 26.MAY.2015 12:45:27



2480MHz



Date: 26.MAY.2015 12:46:58



Date: 26.MAY.2015 12:46:36

9.6 Band edge testing

Test Method

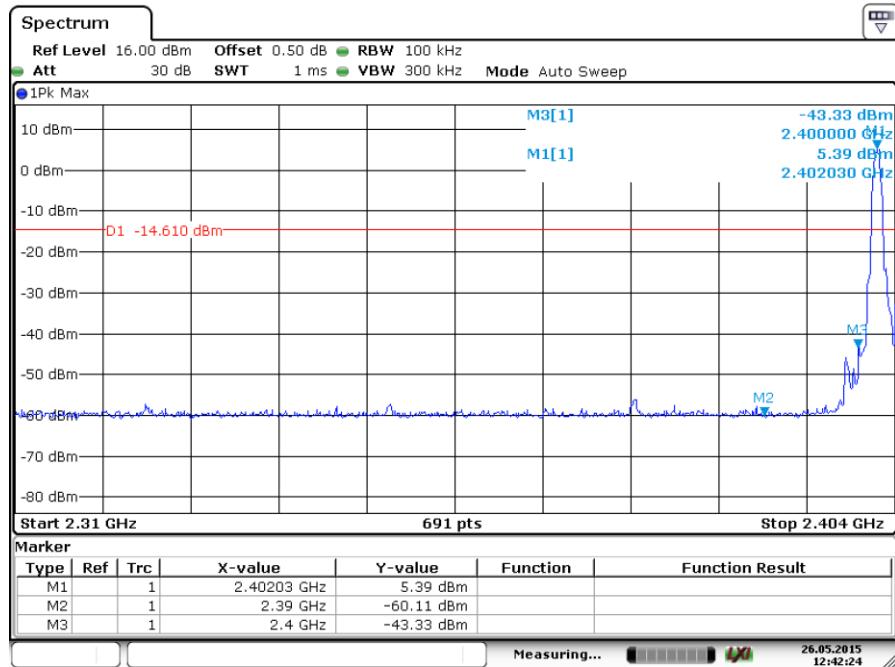
- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max
hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

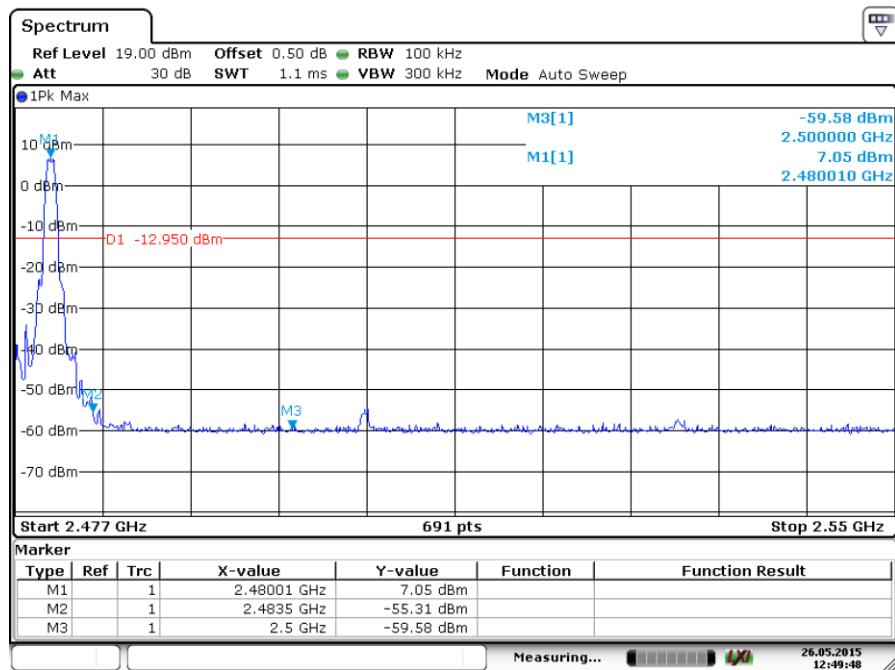
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

Band edge testing

BT4.0 GFSK Modulation Test Result



Date: 26.MAY.2015 12:42:24



Date: 26.MAY.2015 12:49:48

9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for $f \geq 1\text{GHz}$, 100 kHz for $f < 1\text{ GHz}$, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-2009 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc.
The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{duty cycle}/100\text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:

BT4.0 GFSK Modulation 2402MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dB μ V/m		dB μ V/m		dB μ V/m	
2558	49.81	H	74	PK	24.19	Pass
4804	49.90	H	74	PK	24.1	Pass
2559	45.29	V	74	PK	28.71	Pass
4804	53.30	V	74	PK	20.7	Pass

BT4.0 GFSK Modulation 2440MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dB μ V/m		dB μ V/m		dB μ V/m	
2284	50.46	H	74	PK	23.54	Pass
4840	48.36	H	74	PK	25.64	Pass
2284	42.56	V	74	PK	31.44	Pass
4804	53.27	V	74	PK	20.73	Pass

BT4.0 GFSK Modulation 2440MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dB μ V/m		dB μ V/m		dB μ V/m	
212.37	34.68	H	43.5	PK	8.82	Pass
731.79	36.61	H	46	PK	9.39	Pass
2636	50.97	H	74	PK	23.03	Pass
4960	46.91	H	74	PK	27.09	Pass
2324	45.28	V	74	PK	28.72	Pass
4960	52.38	V	74	PK	21.62	Pass

Remark:

- (1) AV Emission Level= PK Emission Level+20log(dutycycle)
- (2) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (3) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

10 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2015-8-17
	LISN	Rohde & Schwarz	ENV4200	100249	2015-8-17
	LISN	Rohde & Schwarz	ENV216	100326	2015-8-17
	ISN	Rohde & Schwarz	ENY81	100177	2015-8-17
	ISN	Rohde & Schwarz	ENY81-CAT6	101664	2015-8-17
	High Voltage Probe	Rohde & Schwarz	TK9420(VT9 420)	9420-58	2015-8-17
	RF Current probe	Rohde & Schwarz	EZ-17	100816	2015-8-17
C	Signal Generator	Rohde & Schwarz	SMB100A	108272	2015-8-17
	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2015-8-17
	Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2015-8-17
	RF Switch Module	Rohde & Schwarz	OSP120/OS P-B157	101226/10085 1	2015-8-17
RE	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2015-8-17
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-17
	Horn Antenna	Rohde & Schwarz	HF907	102294	2017-8-17
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2015-8-17
	3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.83dB; Vertical: 4.91dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Conducted Emission 150KHz-30MHz	U=3.5dB(k=2)