FCC - TEST REPORT

Report Number	:	**68.912.19.0036.01**	Date of Issue:	March 7, 2020
Model	:	**8A-SS-BE-H0**		
Product Type	:	Door/Window sensor		
Applicant	:	LEEDARSON LIGHTING CO., LTD		
Address	:	Xingda Road, Xingtai Industrial Zone, Changtai County, Zhangzhou, Fujian, China		
Production Facility	:	LEEDARSON LIGHTING CO., LTD		
Address	:	Xingda Road, Xingtai Industrial Zone, Changtai County, Zhangzhou, Fujian, China		
Test Result	:	**n Positive o Negative**		
Total pages including Appendices	:	**26**		

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1 Table of Contents

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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 Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
FCC Registration Number:	514049
ISED#:	10320A
CAB identifier:	CN0077
Telephone:	86 755 8828 6998
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3 Description of the Equipment under Test

Product:	Door/Window sensor
Model no.:	8A-SS-BE-H0
FCC ID:	2AB2Q8ASSBEH0
Ratings:	3VDC
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	40
Modulation:	GFSK
Antenna Type:	Integral PCB antenna
Antenna Gain:	1.8dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Door/Window sensor supports 2.4GHz Bluetooth Low Energy functions.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2018 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10 (2013).

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	See note 2		☐	☐	☒
§15.247 (b) (1)	Conducted peak output power	10	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time	---	---	☐	☐	☒
§15.247(a)(2)	6dB bandwidth	12	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	14	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	16	Site 1	☒	☐	☐
§15.247(d)	Band edge	20	Site 1	☒	☐	☐
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	22	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 3		☒	☐	☐

Note 1: N/A=Not Applicable.
Note 2: The EUT is not intended to operate from the AC power lines;
Note 3: The EUT uses an Integral PCB antenna, which gain is 1.8dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID:2AB2Q8ASSBEH0 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment under Test

n - **Fulfills** the general approval requirements.

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

Sample Received Date: December 02, 2019

Testing Start Date: December 02, 2019

Testing End Date: December 07, 2019

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:	Prepared by:	Tested by:
Laurent Yuan	Henry Chen	Louise Liu
EMC Project Manager	EMC Project Engineer	EMC Test Engineer

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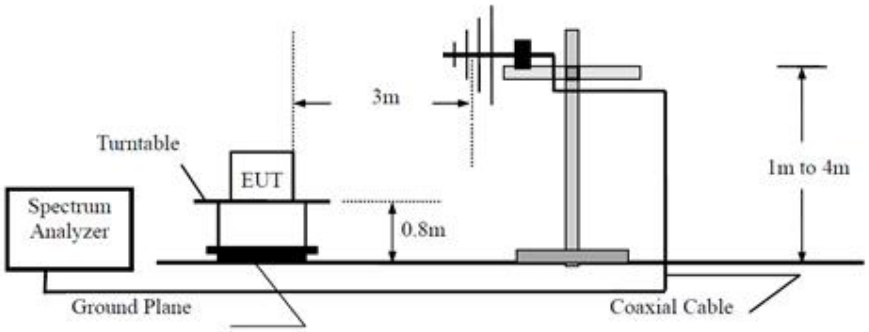
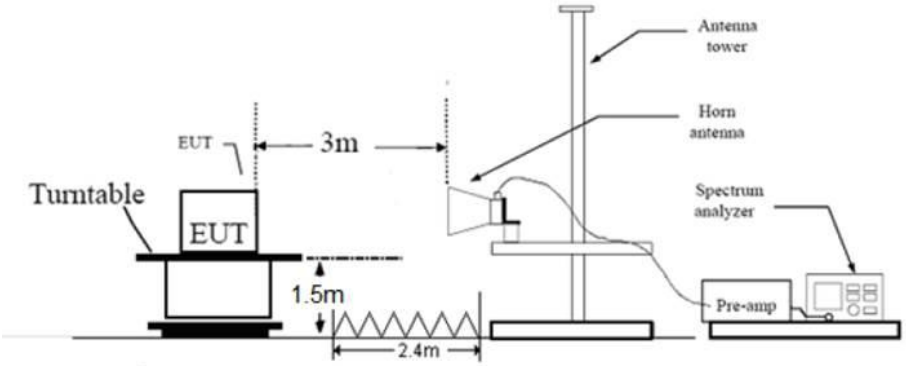
7 Test Setups

7.1 Radiated test setups

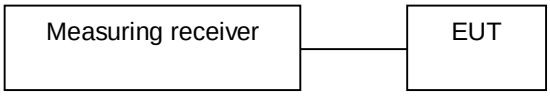
Below 1GHz



Above 1GHz



7.2 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
---	---	---	---

Test software information:

Test Software Version	EMI_Test_Tool	
Modulation	Setting TX Power	Packet Type
GFSK	7dBm	/

The system was configured to channel 0, 19, and 39 for the test.

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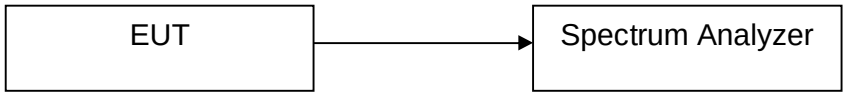
9 Technical Requirement

9.1 Conducted Peak output power

Test Method

1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Setting the highest output power level of the EUT
3. Use the following spectrum analyzer settings:
   RBW≥DTS bandwidth, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold, allow trace to fully stabilize.
4. Record the peak power value.

Test Setup



Limits

According to §15.247 (b) (3), conducted AV output power limit as below:

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

Test result as below table

Frequency MHz	Conducted peak Output Power dBm	Result
Top channel 2402MHz	6.53	Pass
Middle channel 2440MHz	6.65	Pass
Bottom channel 2480MHz	6.72	Pass

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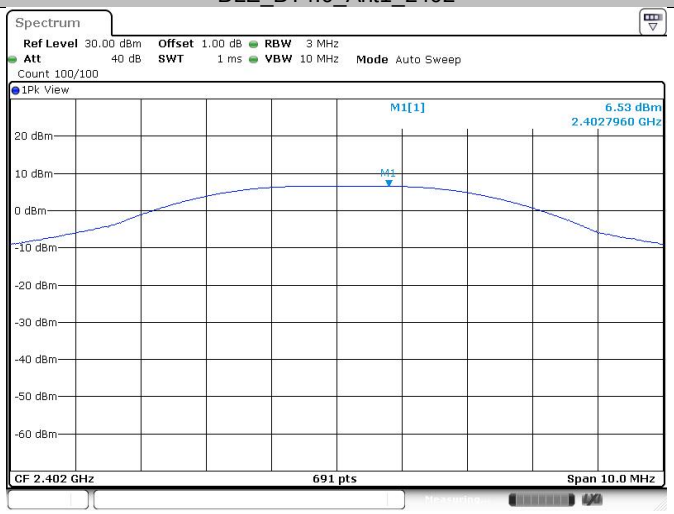
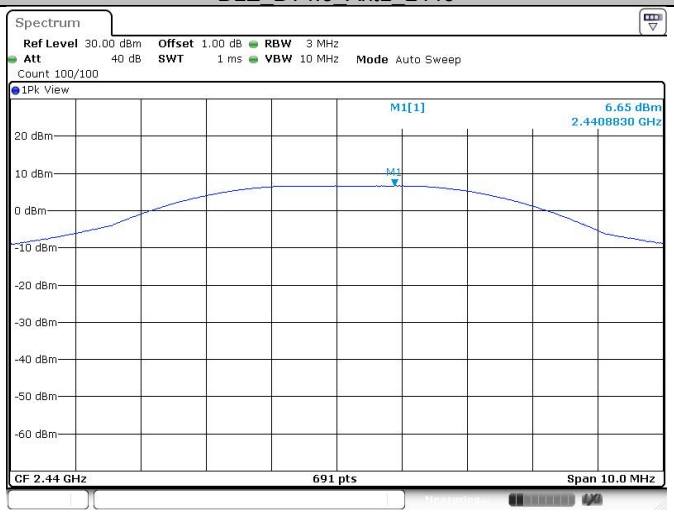
Test Graphs

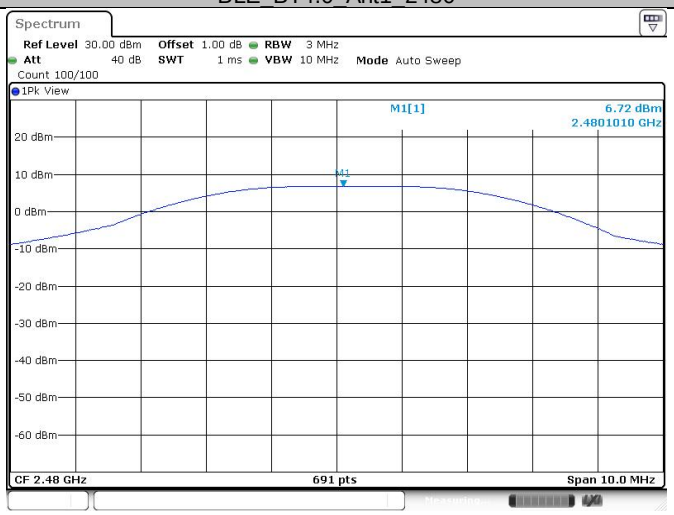
BLE_BT4.0_Ant1_2402



BLE_BT4.0_Ant1_2440



BLE_BT4.0_Ant1_2480



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9.2 6dB bandwidth

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Use the following spectrum analyzer settings:
   Set RBW ³ 1% of the 99% bandwidth, VBW ³ RBW.
   Sweep = auto, Detector function = peak, Trace = max hold
3. 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 ≥ 6 dB.
4. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
≥500

Test result

Test Mode	Channel (MHz)	6dB bandwidth (MHz)	Limit (KHz)	Verdict
BLE	2402	1.208	≥500	PASS
BLE	2440	1.328	≥500	PASS
BLE	2480	1.368	≥500	PASS

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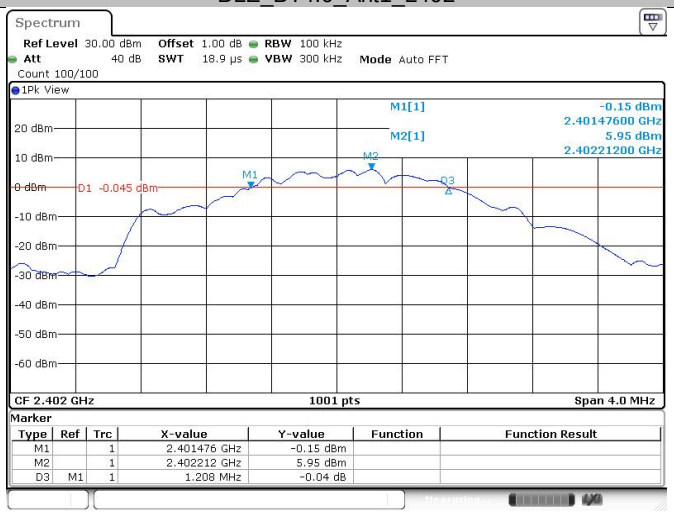
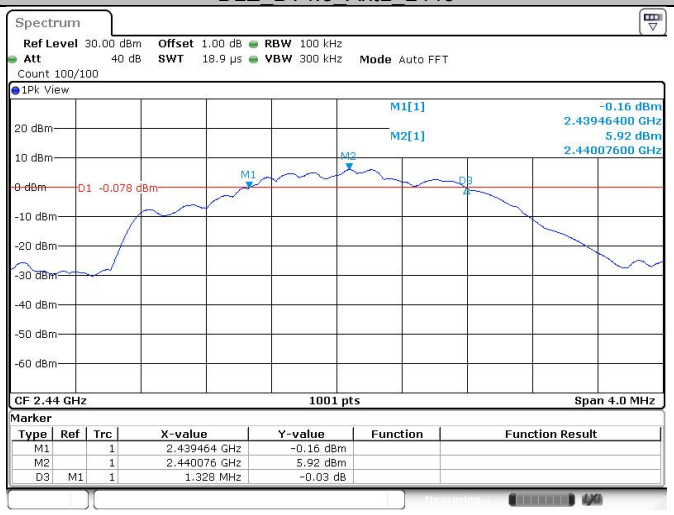
Test Graphs

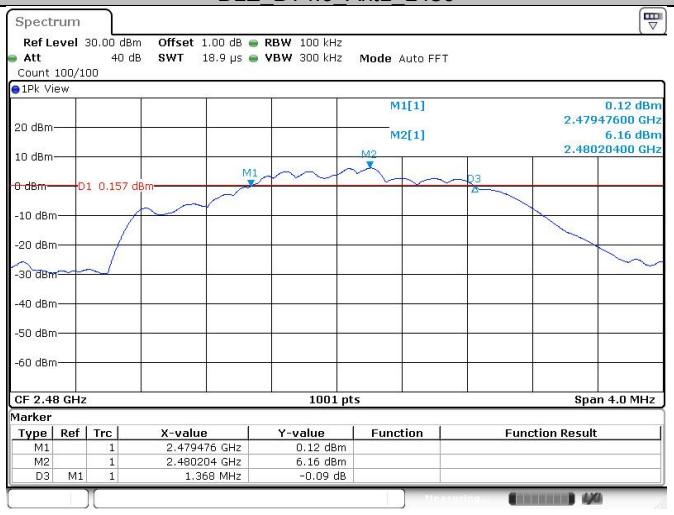
BLE_BT4.0_Ant1_2402



BLE_BT4.0_Ant1_2440



BLE_BT4.0_Ant1_2480



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9.3 Power spectral density

Test Method

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

Limit

Limit [dBm/3KHz]
≤8

Test result

Test Mode	Channel (MHz)	Result (dBm/3KHz)	Limit(dBm/3KHz)	Verdict
BLE	2402	-11.05	8	PASS
BLE	2440	-10.49	8	PASS
BLE	2480	-10.82	8	PASS

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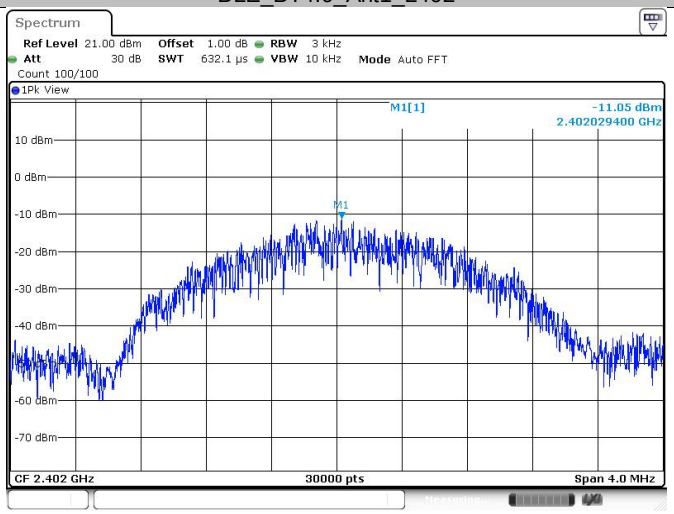
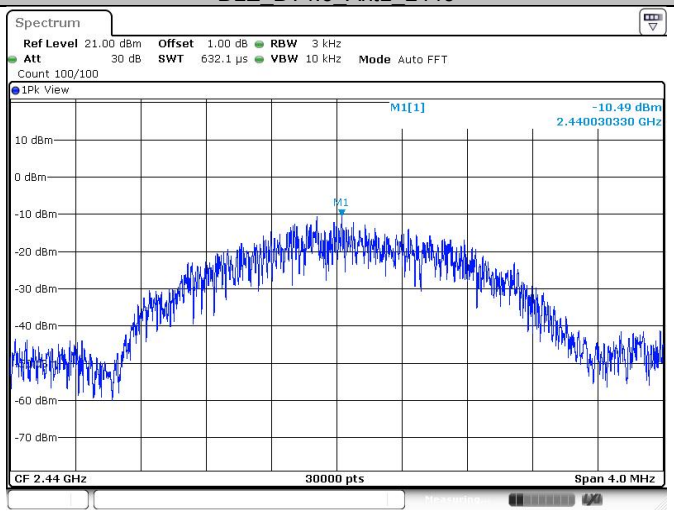
Test Graphs

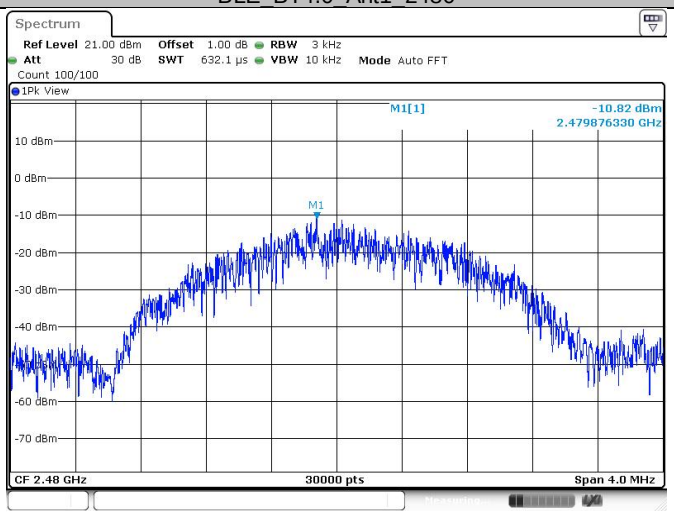
BLE_BT4.0_Ant1_2402



BLE_BT4.0_Ant1_2440



BLE_BT4.0_Ant1_2480



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9.4 Spurious RF conducted emissions

Test Method

1. Connect EUT test port to spectrum analyzer.
2. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
3. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
4. Repeat above procedures until other frequencies measured were completed.

Limit

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

Test Result:

Test Mode	Antenna	Channel (MHz)	Freq Range (MHz)	Ref Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE	ANT1	2402	30~1000	7.73	-67.74	-14.08	PASS
BLE	ANT1	2402	1000~26500	7.73	-51.9	-14.08	PASS
BLE	ANT1	2440	30~1000	7.74	-67.94	-14.04	PASS
BLE	ANT1	2440	1000~26500	7.74	-51.67	-14.04	PASS
BLE	ANT1	2480	30~1000	7.50	-67.06	-14.01	PASS
BLE	ANT1	2480	1000~26500	7.50	-52.13	-14.01	PASS

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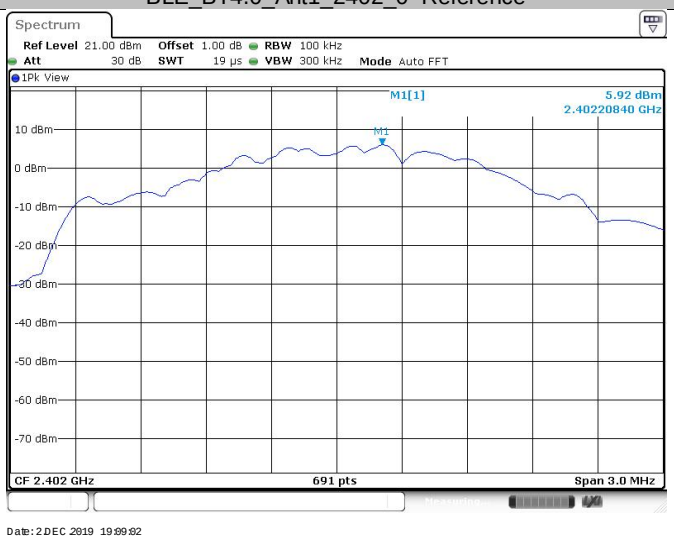
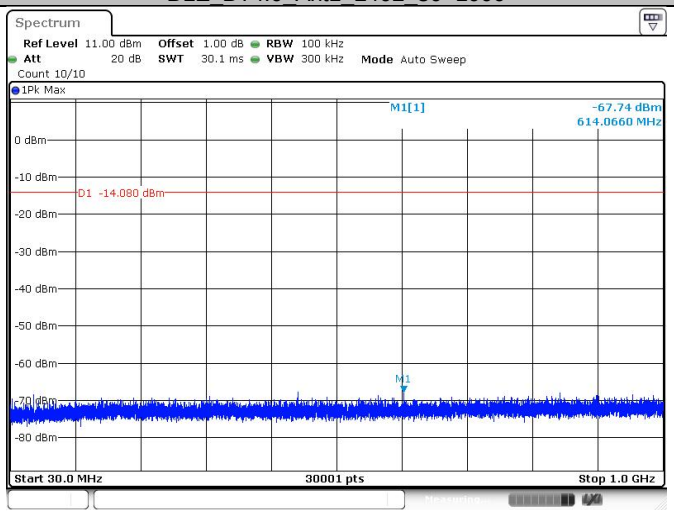
Test Graphs

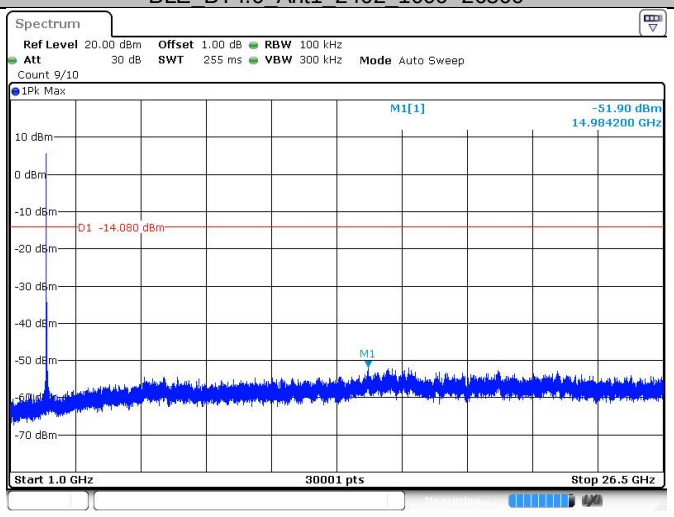
BLE_BT4.0_Ant1_2402_0~Reference



BLE_BT4.0_Ant1_2402_30~1000



BLE_BT4.0_Ant1_2402_1000~26500



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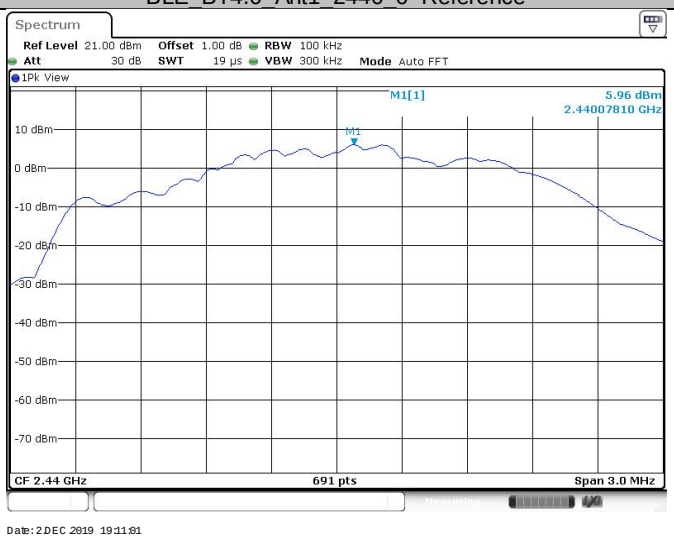
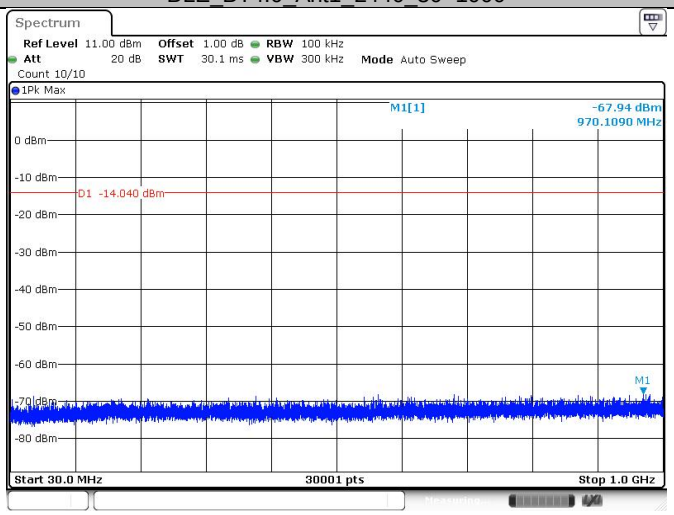
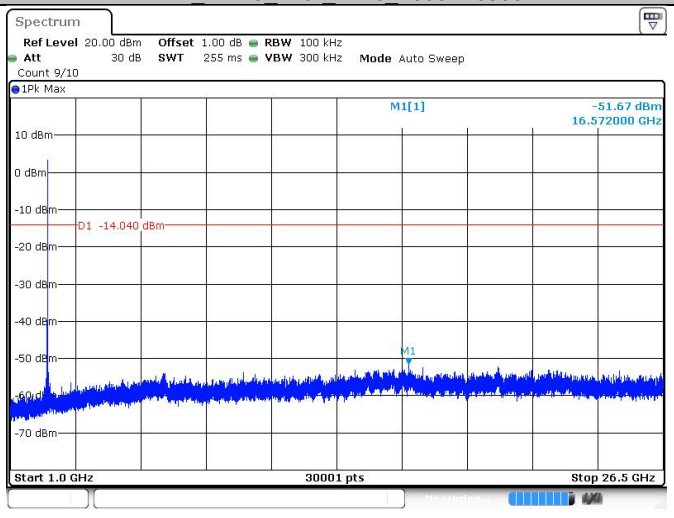
BLE_BT4.0_Ant1_2440_0~Reference



BLE_BT4.0_Ant1_2440_30~1000



BLE_BT4.0_Ant1_2440_1000~26500



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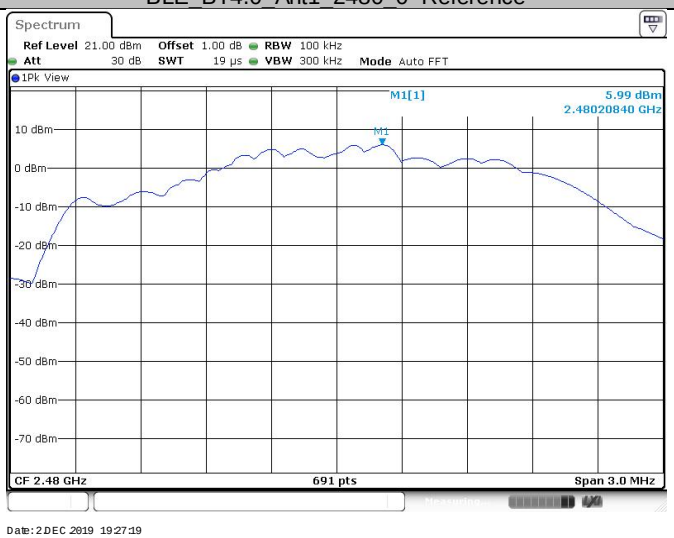
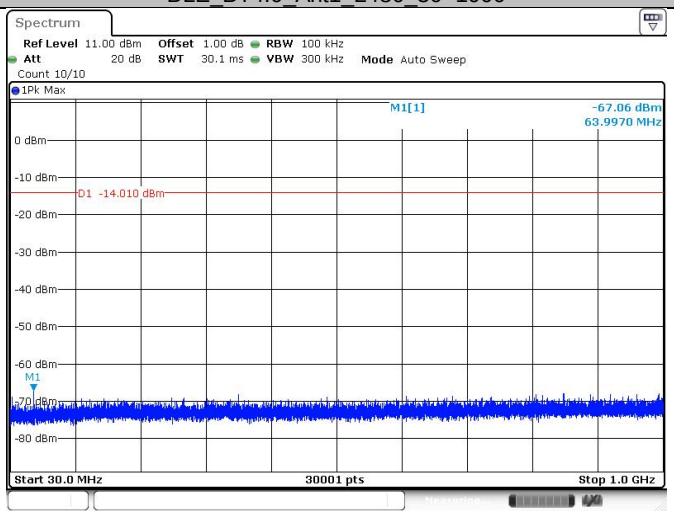
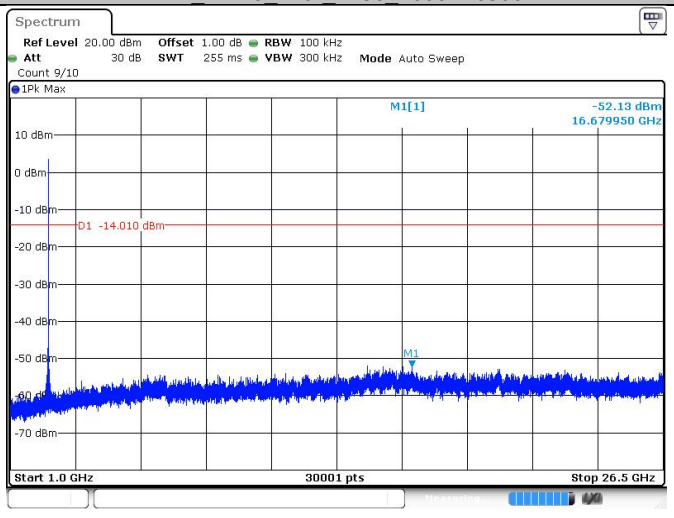
BLE_BT4.0_Ant1_2480_0~Reference



BLE_BT4.0_Ant1_2480_30~1000



BLE_BT4.0_Ant1_2480_1000~26500



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9.5 Band edge

Test Method

1. 1 Connect EUT test port to spectrum analyzer.
2. Set spectrum analyzer setting as below:
   Set RBW ³ 1% of the span, VBW ³ RBW.
   Set Sweep = auto. Set Detector function = peak. Allow the trace to stabilize.
   Set Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
3. Repeat above procedures until all frequencies measured were complete.

Limit

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

Test result

Test Mode	Channel (MHz)	Reference Level(dBm)	Result (dBm)	Limit (dBm)	Verdict
BLE	2402	5.66	-26.82	-14.34	PASS
BLE	2480	5.94	-36.85	-14.06	PASS

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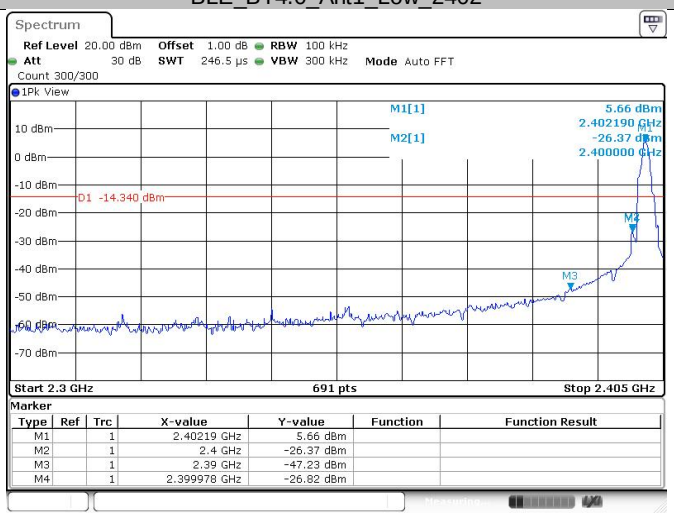
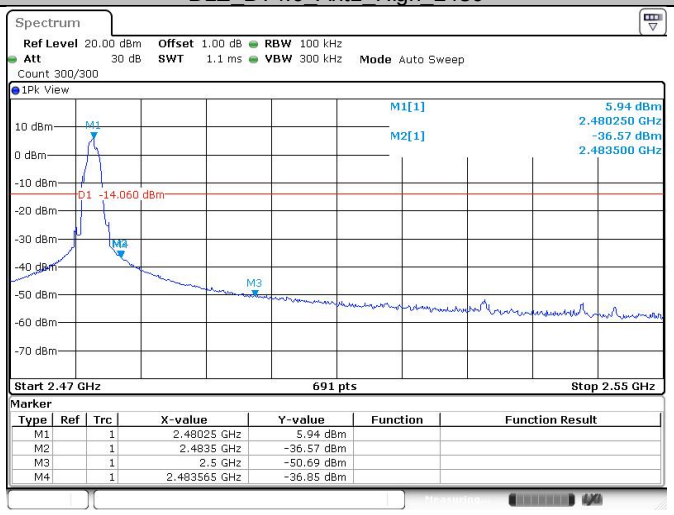
Test Graphs

BLE_BT4.0_Ant1_Low_2402



BLE_BT4.0_Ant1_High_2480



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9.6 Spurious radiated emissions for transmitter

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5: Use the following spectrum analyzer settings According to C63.10:
For Below 1GHz
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 to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement ,Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz
a) RBW = 1 MHz.
b) VBW \ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D,where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty

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cycle was 50%, then 3 dB shall be added to the measured emission levels.
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

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 section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/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

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.

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Spurious radiated emissions for transmitter

Transmitting spurious emission test result as below:

2402MHz (30MHz – 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Margin dB	Detector	Correction Factor dB	Result
674.261875	31.51	Horizontal	46.00	14.49	QP	26.7	Pass
579.808125	28.94	Vertical	46.00	17.06	QP	25.0	Pass

2402MHz (Above 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Margin dB	Detector	Correction Factor dB	Result
15937.968750*	48.17	Horizontal	74.00	25.83	PK	20.9	Pass
15946.406250*	47.93	Horizontal	74.00	26.07	PK	20.8	Pass

2440MHz (30MHz – 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Margin dB	Detector	Correction Factor dB	Result
/	/	Horizontal	/	/	QP	/	/
/	/	Vertical	/	/	QP	/	/

2440MHz (Above 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Margin dB	Detector	Correction Factor dB	Result
15957.187500*	48.33	Horizontal	74.00	25.67	PK	20.6	Pass
15982.500000*	48.21	Horizontal	74.00	25.79	PK	20.1	Pass

2480MHz (30MHz – 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Margin dB	Detector	Correction Factor dB	Result
/	/	Horizontal	/	/	QP	/	/
/	/	Vertical	/	/	QP	/	/

2480MHz (Above 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Margin dB	Detector	Correction Factor dB	Result
15942.187500*	48.21	Horizontal	74.00	25.79	PK	20.9	Pass
15936.093750*	48.26	Horizontal	74.00	25.74	PK	20.8	Pass

Remark:

1: 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.

2: "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

3: Emission Level = Reading Level + Correction Factor
Below 1GHz: Correction Factor=Antenna Factor + Cable Loss
Above 1GHz: Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain
(The Reading Level is recorded by software which is not shown in the sheet)

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10 Test Equipment List

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2020-6-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-002	707	1	2020-8-20
Horn Antenna	Rohde & Schwarz	HF907	68-4-80-14-005	102294	1	2020-6-22
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2020-7-7
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2020-6-28
Signal Generator	Rohde & Schwarz	SMY01	68-4-48-16-001	839369/005	1	2020-6-28
Attenuator	Agilent	8491A	68-4-81-16-001	MY39264334	1	2020-6-28
3m Semi-anechoic chamber	TDK	9X6X6	68-4-90-14-001	----	3	2020-7-7
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version9.15.00	N/A	N/A

TS8997 Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	68-4-48-14-001	108272	1	2020-6-28
Vector Signal Generator	Rohde & Schwarz	SMBV100A	68-4-48-18-001	262825	1	2020-6-28
Communication Synthetical Test Instrument	Rohde & Schwarz	CMW 270	68-4-48-18-003	101251	1	2020-5-31
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2020-6-28
Vector Signal Generator	Rohde & Schwarz	SMU 200A	68-4-48-14-003	105324	1	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	68-4-93-14-003	101226/100851	1	2020-6-28
Power Splitter	Weinschel	1580	68-4-85-14-001	SC319	1	2020-7-7
10dB Attenuator	Weinschel	4M-10	68-4-81-14-003	43152	1	2020-7-6
10dB Attenuator	R&S	DNF	68-4-81-14-004	DNF-001	1	2020-6-28
10dB Attenuator	R&S	DNF	68-4-81-14-005	DNF-002	1	2020-6-28
10dB Attenuator	R&S	DNF	68-4-81-14-006	DNF-003	1	2020-6-28
10dB Attenuator	R&S	DNF	68-4-81-14-007	DNF-004	1	2020-6-28
Test software	Rohde & Schwarz	EMC32	68-4-48-14-003-A10	Version 10.38.00	N/A	N/A
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.5.77.0418	N/A	N/A
Shielding Room	TDK	TS8997	68-4-90-19-003	----	1	2020-7-19

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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 Spurious Emission 25MHz-3000MHz	Horizontal: 4.81dB; Vertical: 4.89dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.69dB; Vertical: 4.68dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.89dB; Vertical: 4.87dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10^{-7} or 1%
Uncertainty Evaluation for Power Spectral Density Conducted measurement	1.17dB
Uncertainty Evaluation for Spurious emissions Conducted measurement	1.43dB
Uncertainty Evaluation for ACS and Blocking of Radiated method	4.11dB
Uncertainty Evaluation for ACS, Blocking and Overloadind of Conducted method	0.831dB
Uncertainty Evaluation for Sensitivity of Conducted method	0.816dB
Uncertainty Evaluation for Sensitivity of Radiated method	2.29dB
Uncertainty Evaluation for Humidity	0.936%
Uncertainty Evaluation for Temperature	0.195 °C

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