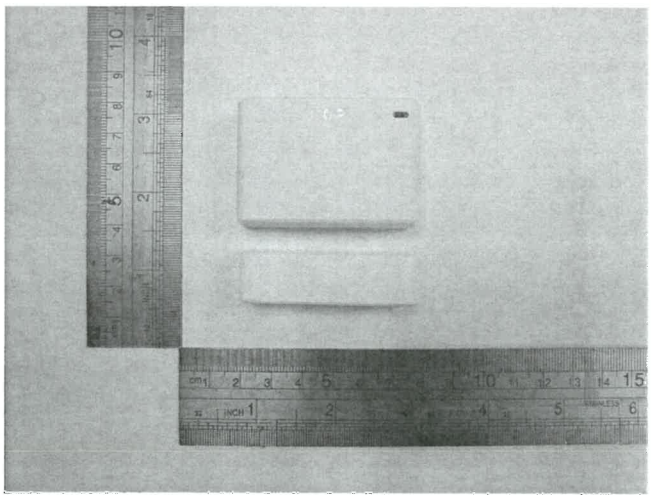
Prüfbericht-Nr.: *Test Report No.:*	**50126594 001**	**Auftrags-Nr.:** *Order No.:*	144175480	**Seite 1 von 14** *Page 1 of 14*
Kunden-Referenz-Nr.: *Client Reference No.:*	N/A	**Auftragsdatum:** *Order date:*	12.02.2018	
Auftraggeber: *Client:*	**Kopi Incorporation Limited Unit 716, 7/F, Vanta Industrial Centre, 21-33 Tai Lin Pai Road, Kwai Chung, N.T., Hong Kong**			
Prüfgegenstand: *Test item:*	**Bluetooth Low Energy Device - Contact Sensor**			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	**KMS100**			
Auftrags-Inhalt: *Order content:*	FCC Certification			
Prüfgrundlage: *Test specification:*	**FCC Part 15 Subpart C ANSI C63.10-2013**			

Wareneingangsdatum: *Date of receipt:*	15.02.2018
Prüfmuster-Nr.: *Test sample No.:*	A000698931-001
Prüfzeitraum: *Testing period:*	23.04.2018
Ort der Prüfung: *Place of testing:*	TÜV Rheinland Hong Kong Ltd
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland Hong Kong Ltd
Prüfergebnis*: *Test result*:*	Pass



geprüft von / *tested by:*			**kontrolliert von** / *reviewed by:*		
05.07.2018	Kevin Wong / Project Manager		05.07.2018	Joey Leung / Project Manager	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other:* **FCC ID: 2ABRB-KMS100**

This report covers partial test requirement under CFR47 FCC Part 15: Subpart C Section 15.247.
This report should be read in conjunction with report number 180307016RFC-1.

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Table of Content

Page

Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	PCB Antenna
Antenna gain (dBi)	4 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V_{nor}: 3VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a Bluetooth low energy device.

FCC ID: 2ABRB-KMS100

Models	Product description
KMS100	Contact Sensor

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

- none

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- During test, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

- none

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360 ° , the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

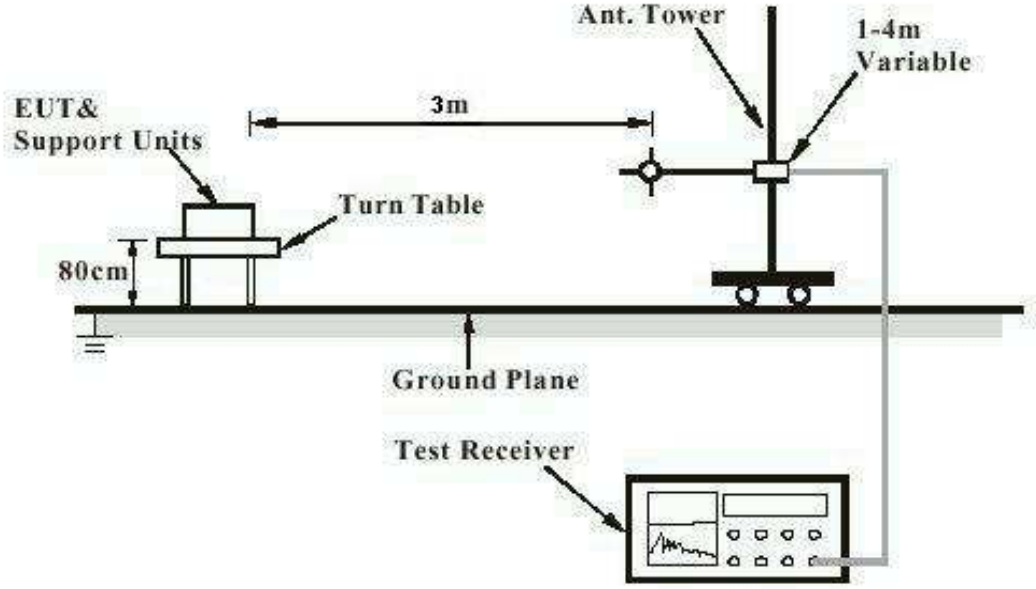
FS = R + AF + CF + FA – PA

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

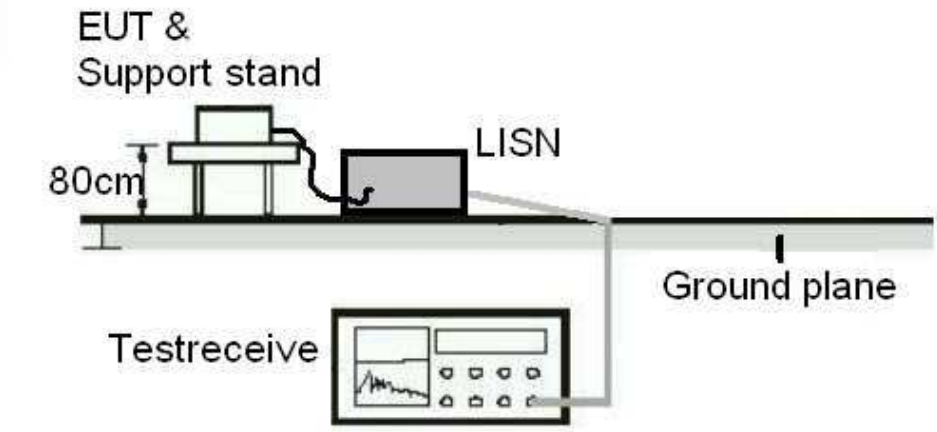
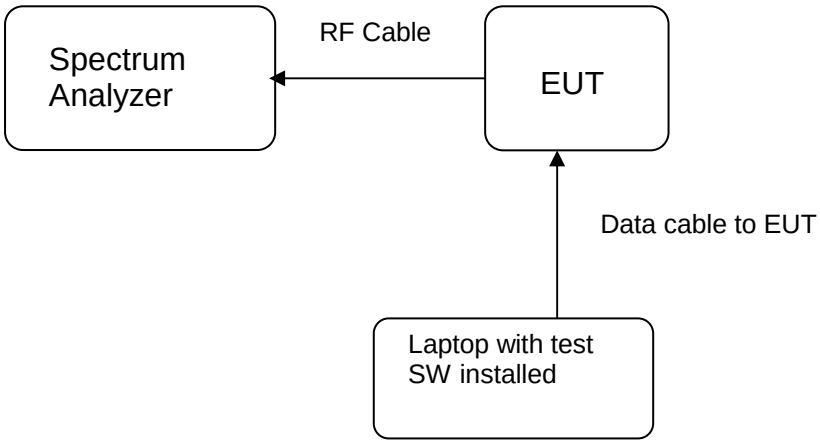


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.
Address: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong·
Tel.: +852 2192 1000
Fax: +852 2192 1001
Email service-gc@tuv.com
Web: www.tuv.com

The test facility is recognized or accredited by the following organizations:

FCC

Type	:	Accredited Test Firm
Designation Number	:	HK0013
Test Firm Registration Number	:	371735
Scope	:	Intentional Radiators

List of Test and Measurement Instruments

TÜV Rheinland Hong Kong Ltd

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	28-Sep-17	28-Sep-18

Measurement Uncertainty

The estimated combined standard uncertainty for antenna conducted emission is ±2.1dB

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of k=2, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		**Pass**
FCC Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	a) Antenna type: b) Manufacturer and model no: c) Peak Gain:	Integral PCB antenna N/A 4 dBi
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2	**N/A**
FCC Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.
Results:	Only one integral antenna can be used.
Verdict:	N/A

FCC 15.207 – Conducted Emission on AC Mains	**N/A**
There is no AC power input or output ports on the EUT.	

FCC 15.247 (a)(2) – 6dB Bandwidth Measurement	**Pass**
FCC Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.	
Test Specification : ANSI C63.10 – 2013 Test date : 23.04.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3VDC Temperature : 23ºC Humidity : 50%	
Results: For test protocols please refer to Appendix 1	

Channel frequency (MHz)	**6 dB left (MHz)**	**6 dB right (MHz)**	**6dB bandwidth (kHz)**
2402	2401.604	2402.304	700
2440	2439.610	2440.306	696
2480	2479.604	2480.306	702

FCC 15.247(b)(3) – Maximum Peak Couducted Output Power	**Pass**
FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)	
Test Specification : ANSI C63.10 – 2013 Test date : 23.04.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3VDC Temperature : 23ºC Humidity : 50%	
Results: For test protocols please refer to Appendix 1	

Frequency (MHz)	**Measured Output Power (dBm)**	**Limit (W/dBm)**	**Verdict**
2402	-1.19	1 / 30.0	Pass
2440	-1.48	1 / 30.0	Pass
2480	-1.83	1 / 30.0	Pass

FCC 15.247(e) – Power Spectral Density	**Pass**
FCC Requirement:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Specification : ANSI C63.10 – 2013
Test date : 23.04.2018
Mode of operation : Tx mode
Port of testing : Temporary antenna port
Supply voltage : 3VDC
Temperature : 23ºC
Humidity : 50%

Results: For test protocols please refer to Appendix 1.

Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-0.93	8.0	Pass
2440	-1.24	8.0	Pass
2480	-1.60	8.0	Pass

FCC 15.247(d) – Spurious Conducted Emissions	**Pass**

Test Specification : ANSI C63.10 – 2013
Test date : 23.04.2018
Mode of operation : Tx mode
Port of testing : Temporary antenna port
Supply voltage : 3VDC
Temperature : 23ºC
Humidity : 50%

FCC Requirement: 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.

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

Only the worst cases is shown below. For test protocols refer to Appendix 1

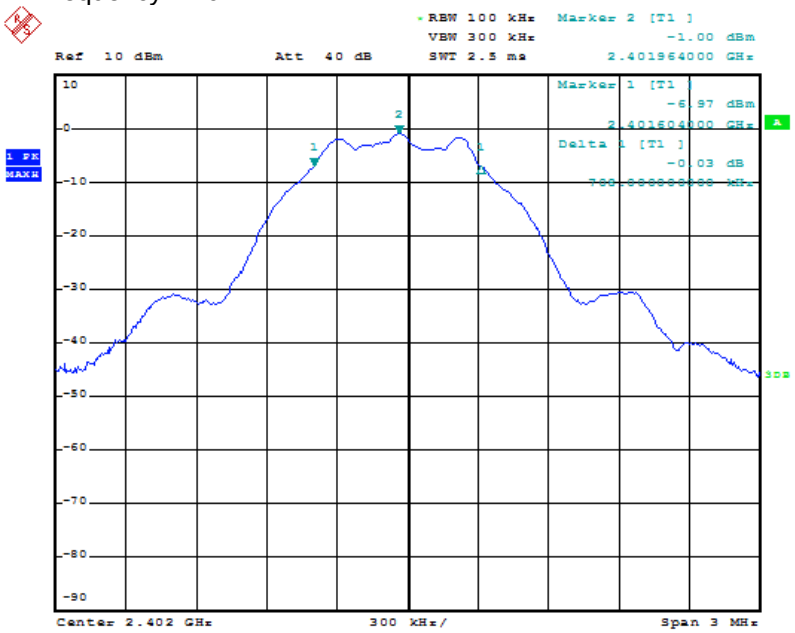
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	2276.000	-46.73	-0.93	-45.80	Pass
2440	2312.000	-46.18	-1.24	-44.94	Pass
2480	2352.000	-46.77	-1.60	-45.17	Pass

Appendix 1

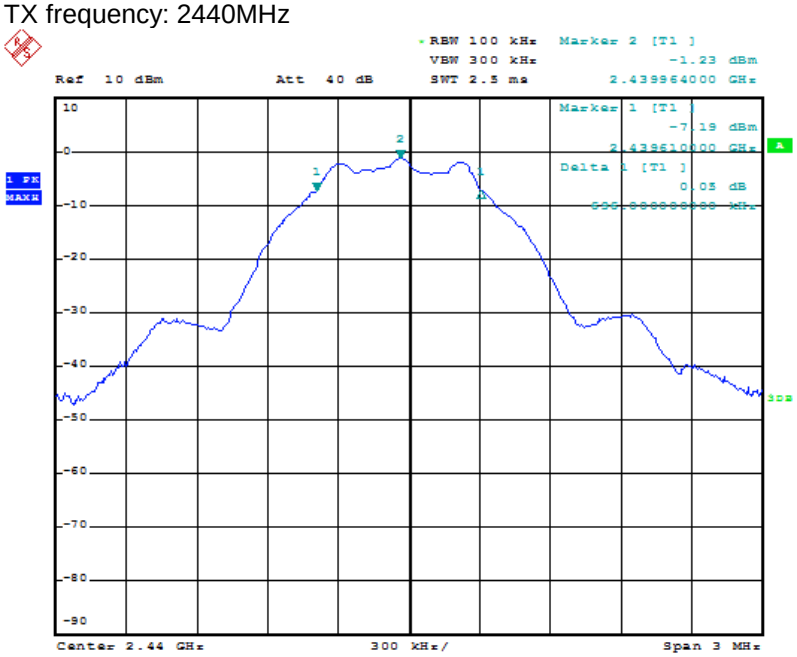
Test protocols

6 dB Bandwidth Measurement

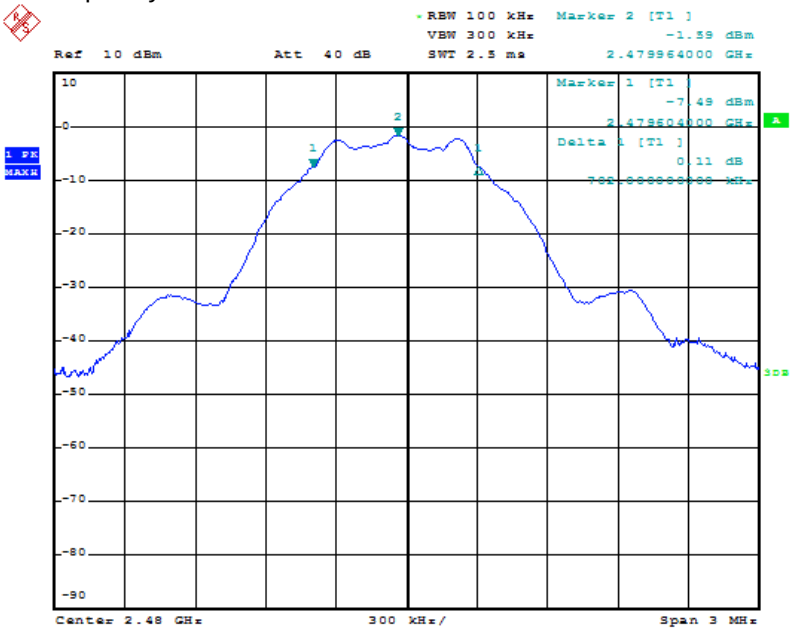
TX frequency: 2402MHz



TX frequency: 2440MHz

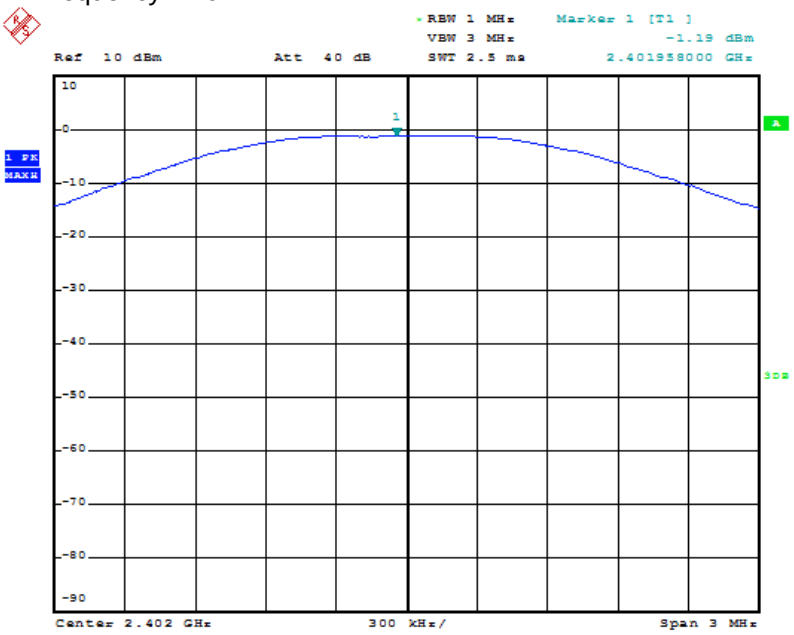


TX frequency: 2480MHz

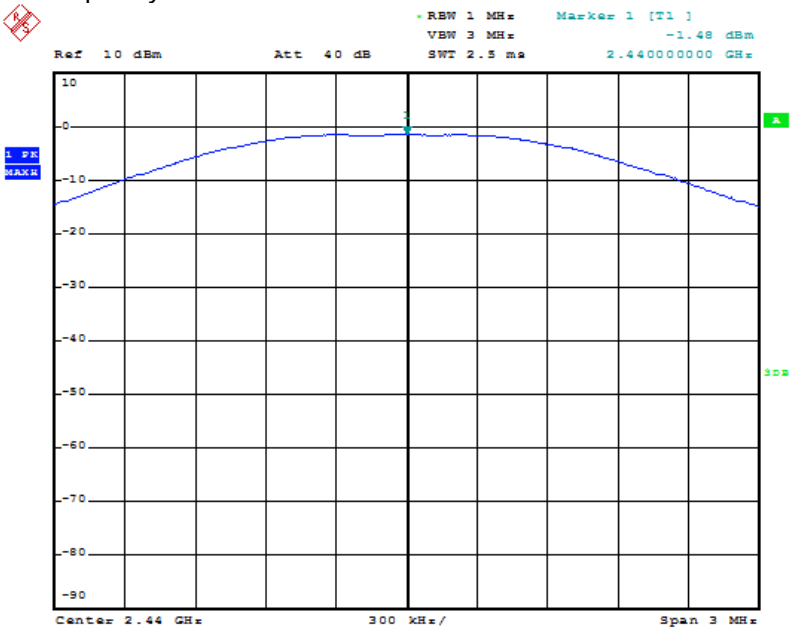


Maximum Peak Conducted Output power

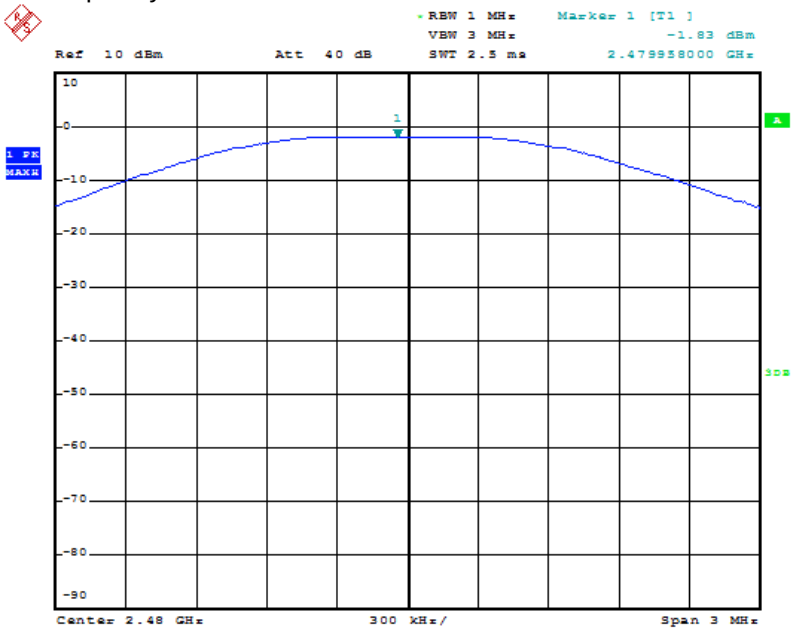
TX frequency: 2402MHz



TX frequency: 2440MHz

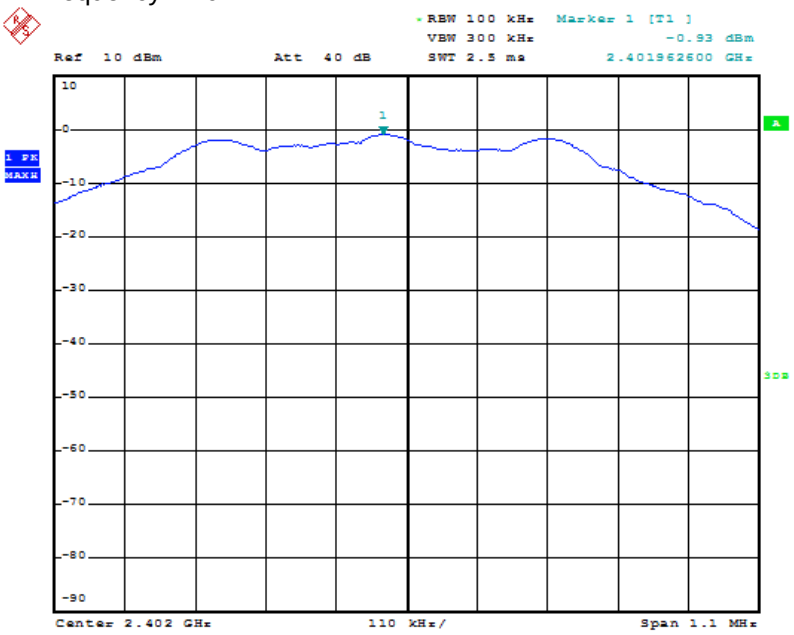


TX frequency: 2480MHz

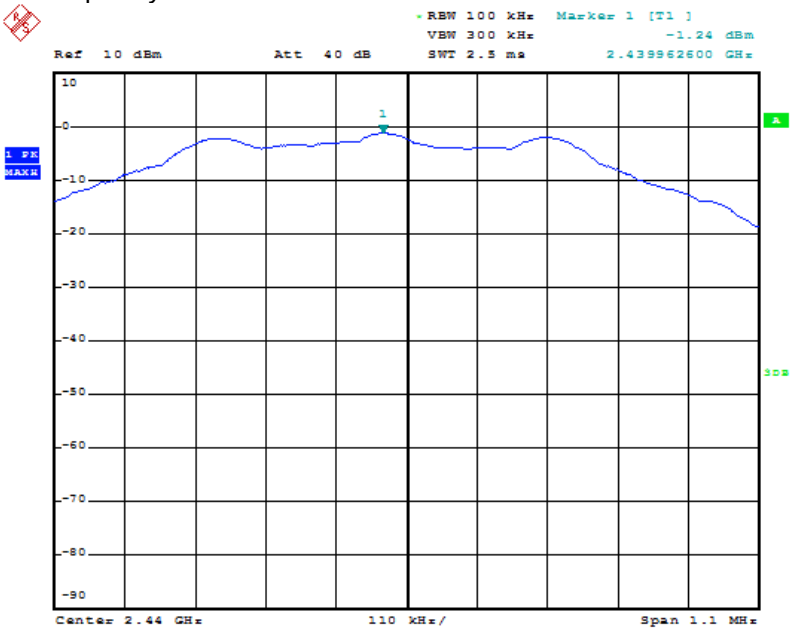


Power Spectral Density

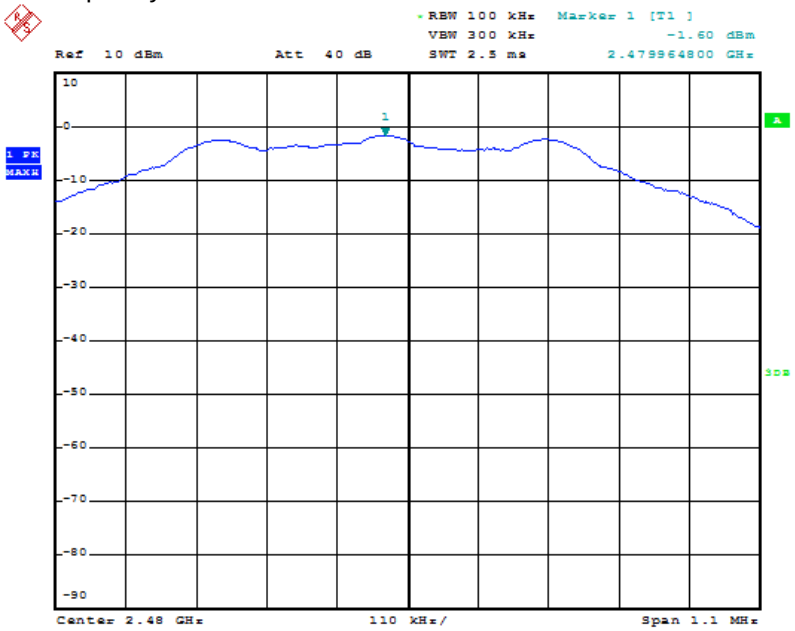
TX frequency: 2402MHz



TX frequency: 2440MHz

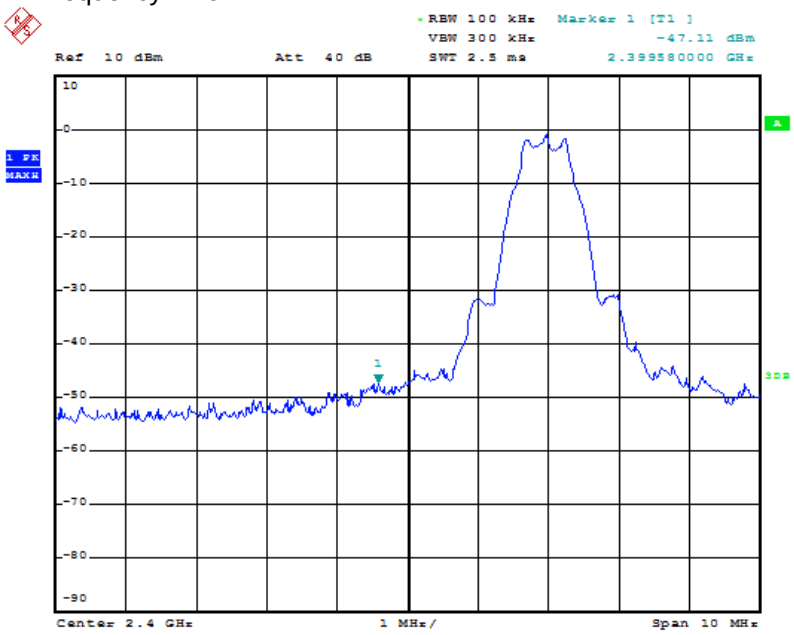


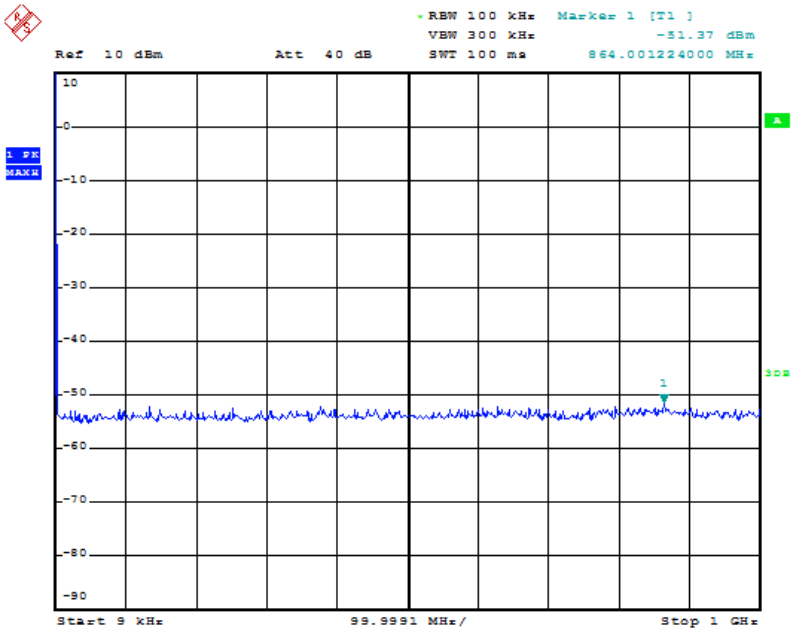
TX frequency: 2480MHz

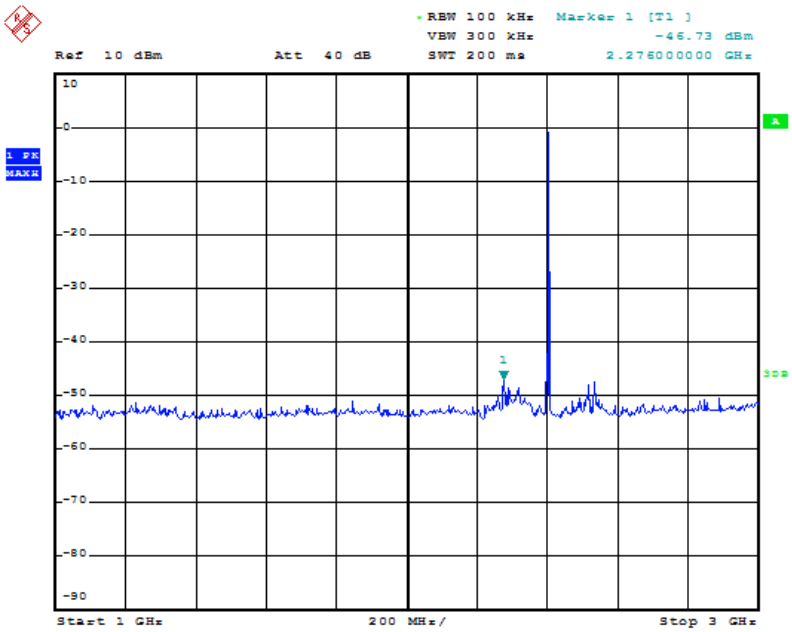


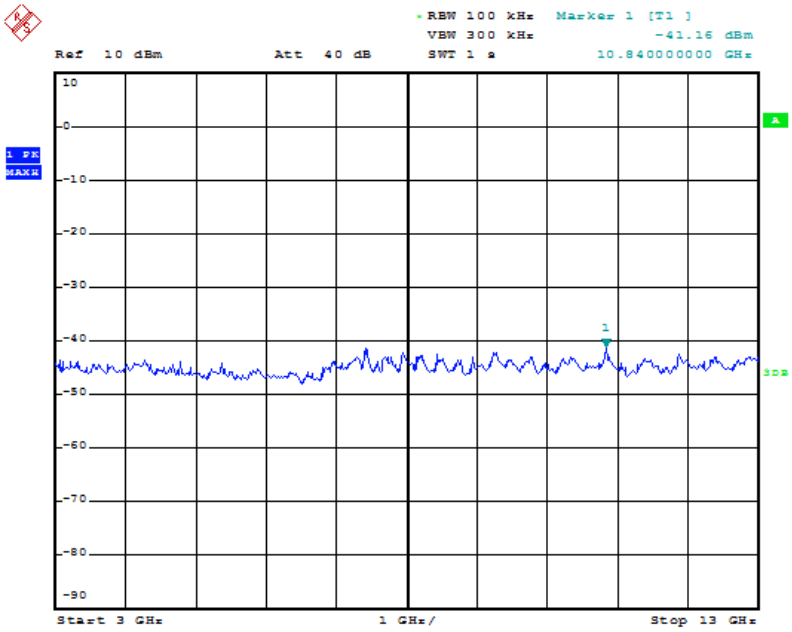
Spurious Conducted Emissions

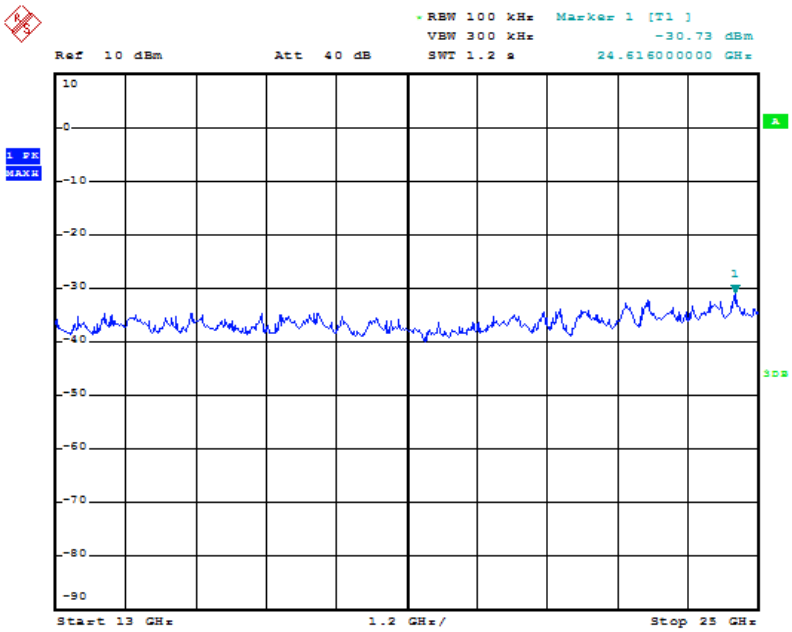
TX frequency: 2402MHz



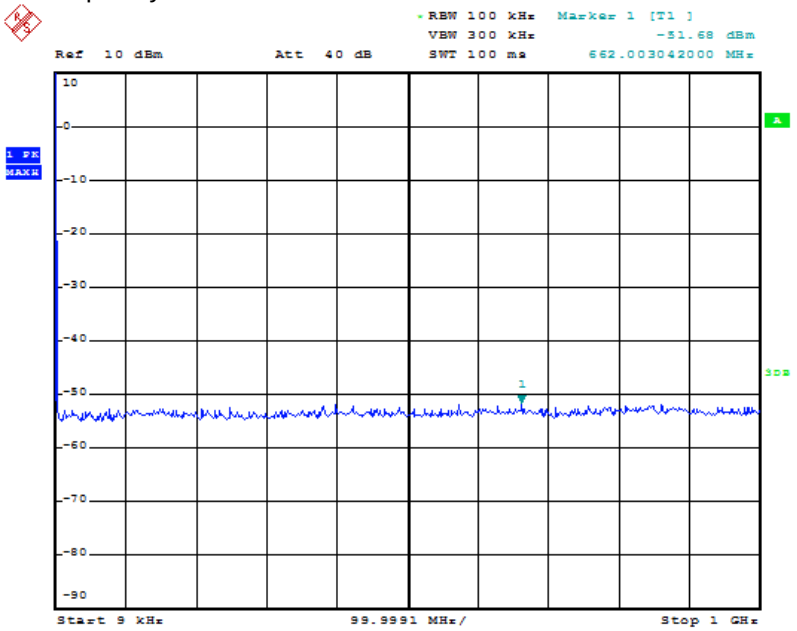


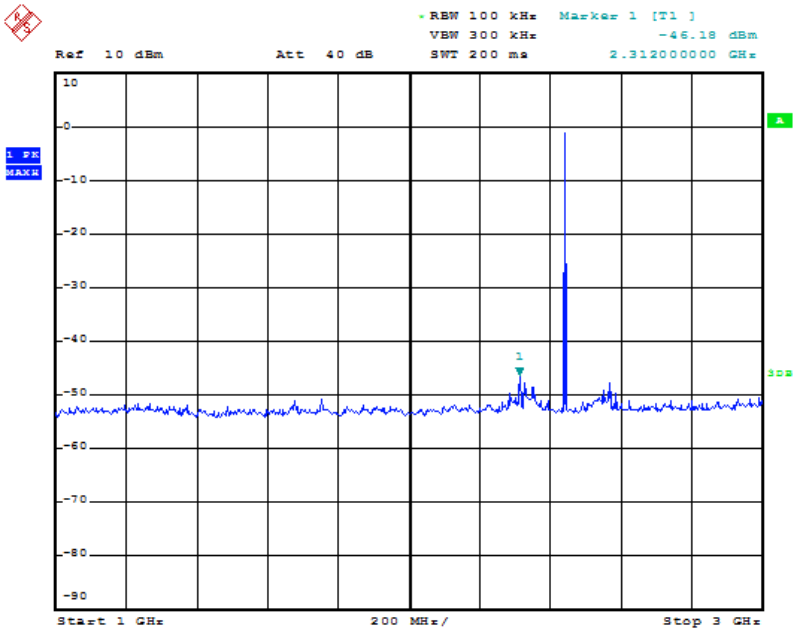

RBW 100 kHz
VBW 300 kHz
SWT 200 ms
Marker 1 [T1]
-46.73 dBm
2.276000000 GHz
Ref 10 dBm
Att 40 dB
1 PK MAXH
A
1
SDB
Start 1 GHz
200 MHz/
Stop 3 GHz

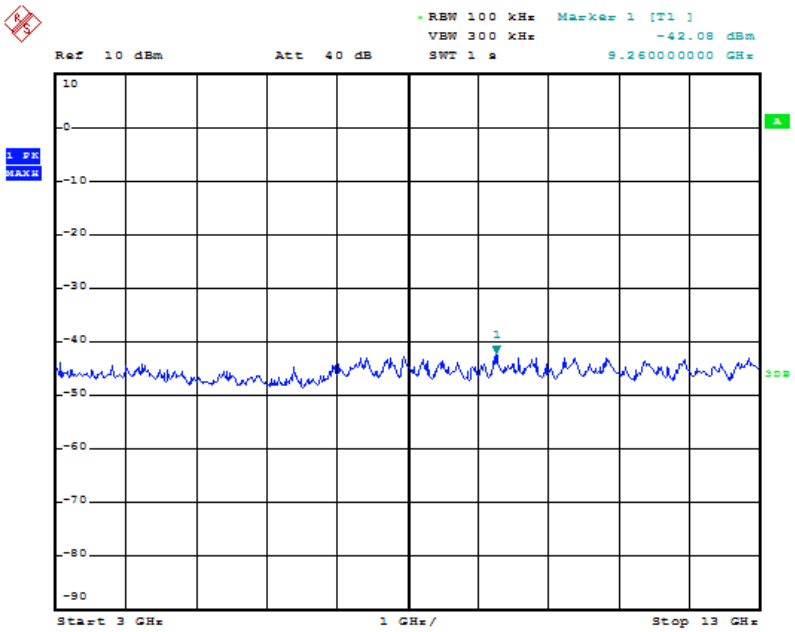

RBW 100 kHz
VBW 300 kHz
SWT 1 s
Marker 1 [T1]
-41.16 dBm
10.840000000 GHz
Ref 10 dBm
Att 40 dB
1 PK MAXH
A
1
SDB
Start 3 GHz
1 GHz/
Stop 13 GHz

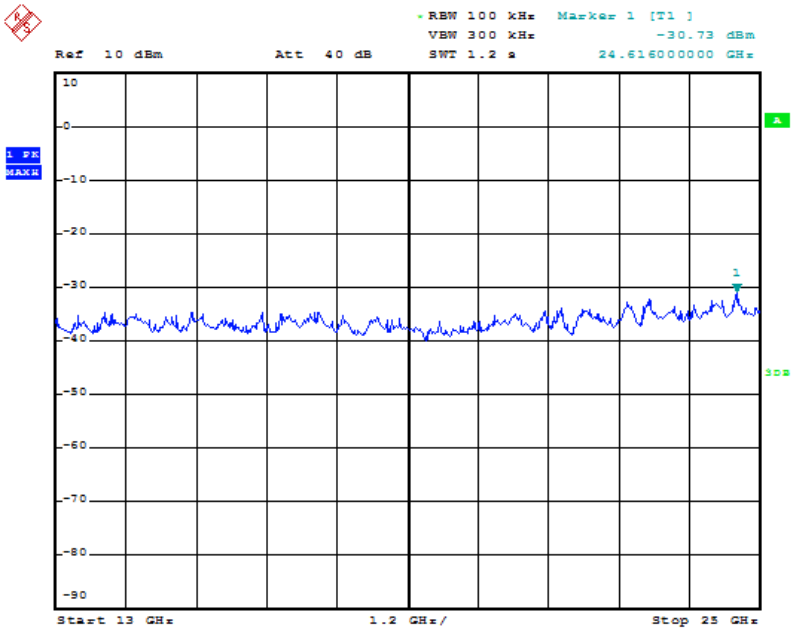

RBW 100 kHz
VBW 300 kHz
SWT 1.2 s
Marker 1 [T1]
-30.73 dBm
24.616000000 GHz
Ref 10 dBm
Att 40 dB
1 PK
MAXH
A
1
SDB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 13 GHz
1.2 GHz/
Stop 25 GHz

TX frequency: 2440MHz

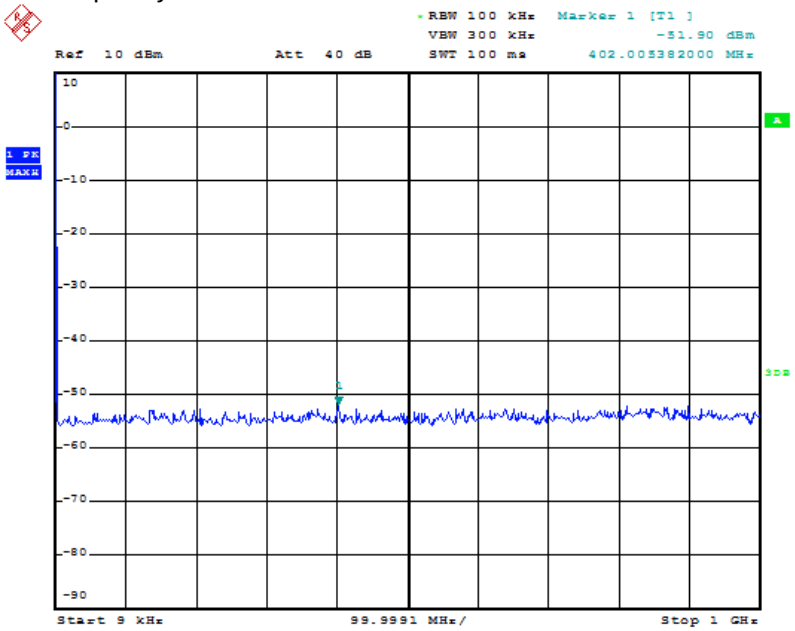


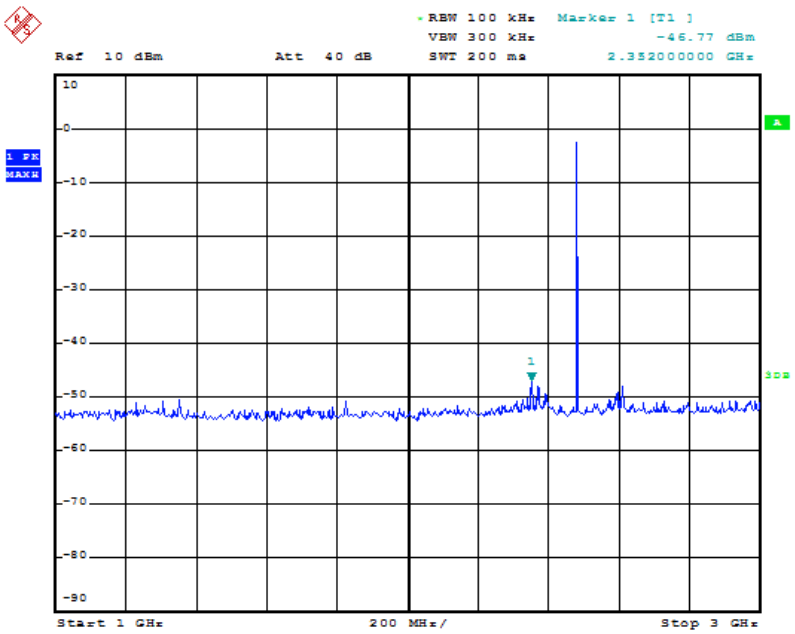


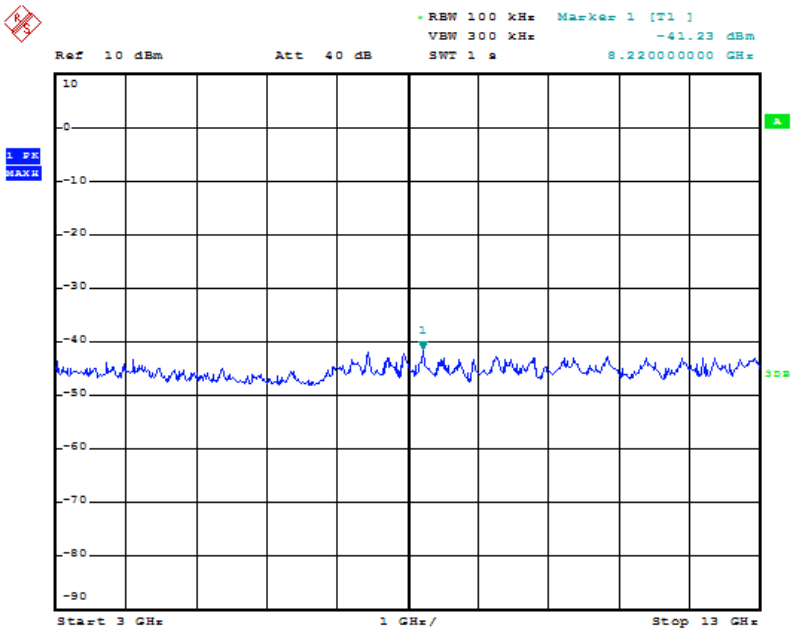

RBW 100 kHz
VBW 300 kHz
SWT 1 s
Marker 1 [T1]
-42.08 dBm
9.260000000 GHz
Ref 10 dBm
Att 40 dB
1 PK
MAXH
A
3DB
Start 3 GHz
1 GHz/
Stop 13 GHz

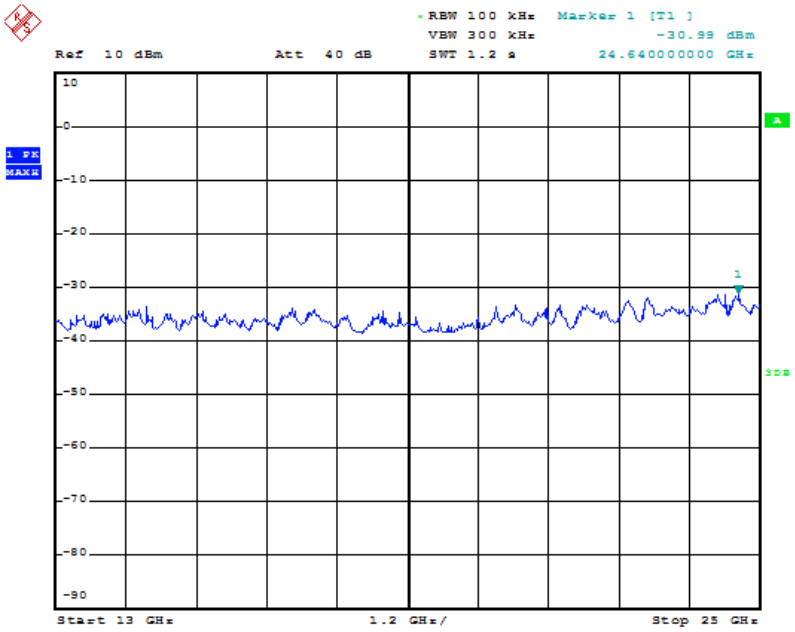

RBW 100 kHz
VBW 300 kHz
SWT 1.2 s
Marker 1 [T1]
-30.73 dBm
24.616000000 GHz
Ref 10 dBm
Att 40 dB
1 PK
MAXH
A
3DB
Start 13 GHz
1.2 GHz/
Stop 25 GHz

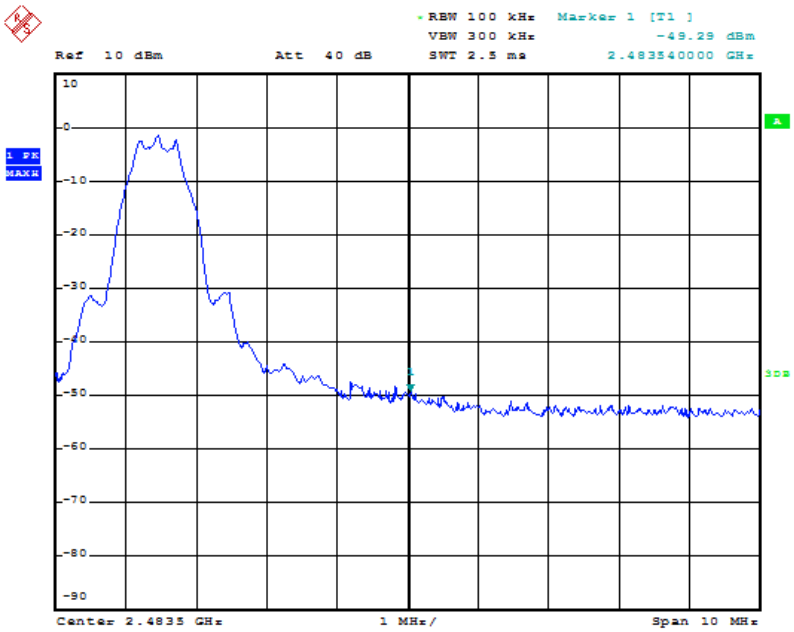
TX frequency: 2480MHz






RBW 100 kHz
VBW 300 kHz
SWT 1 s
Marker 1 [T1]
-41.23 dBm
8.220000000 GHz
Ref 10 dBm
Att 40 dB
1 PK
MAXH
A
3DB
Start 3 GHz
1 GHz/
Stop 13 GHz


RBW 100 kHz
VBW 300 kHz
SWT 1.2 s
Marker 1 [T1]
-30.99 dBm
24.640000000 GHz
Ref 10 dBm
Att 40 dB
1 PK
MAXH
A
3DB
Start 13 GHz
1.2 GHz/
Stop 25 GHz

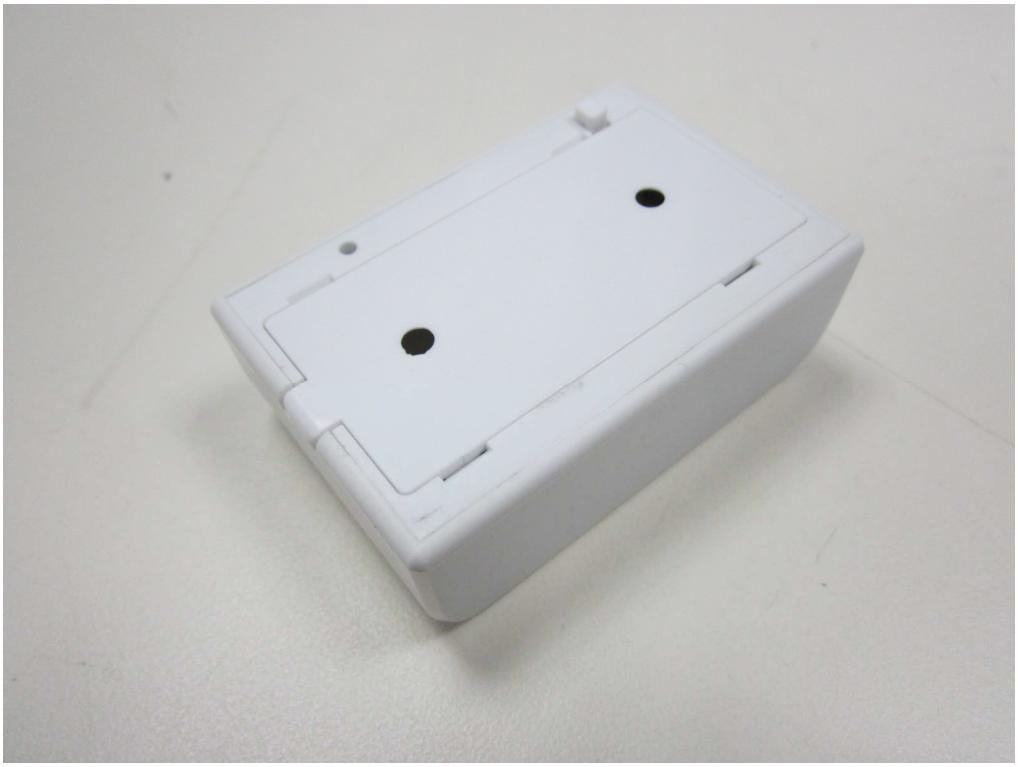

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
-49.29 dBm
2.483540000 GHz
Ref 10 dBm
Att 40 dB
1 PK
MAXH
A
3DB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.4835 GHz
1 MHz/
Span 10 MHz

Appendix 2

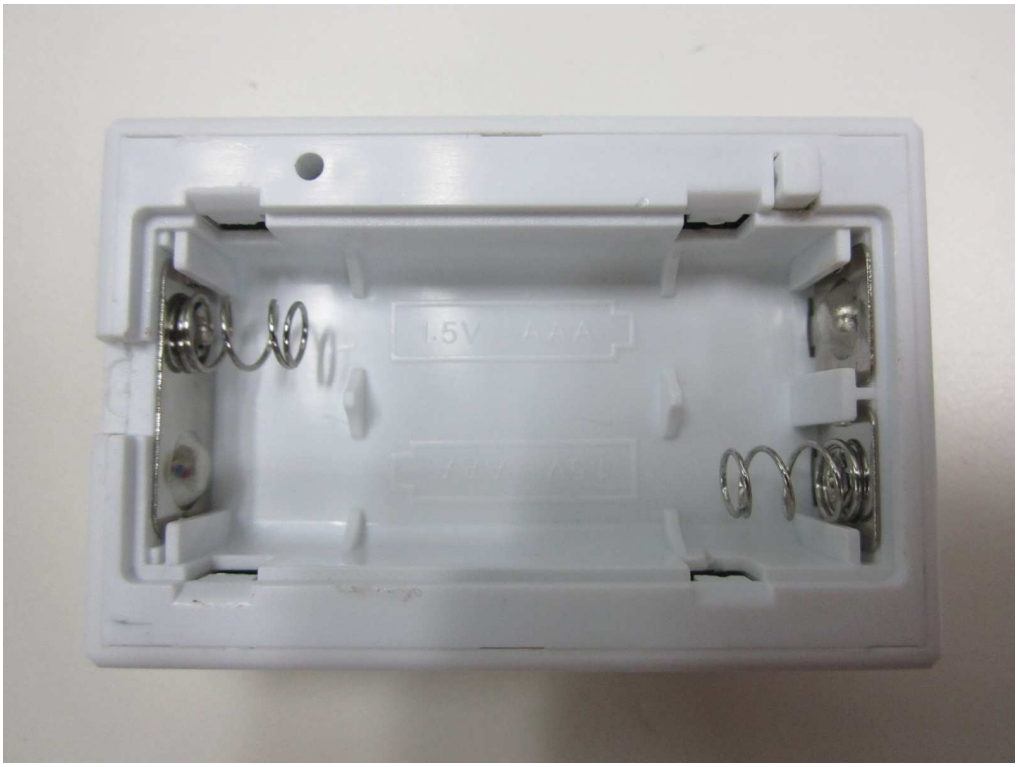
EUT External Photos

External View

External View



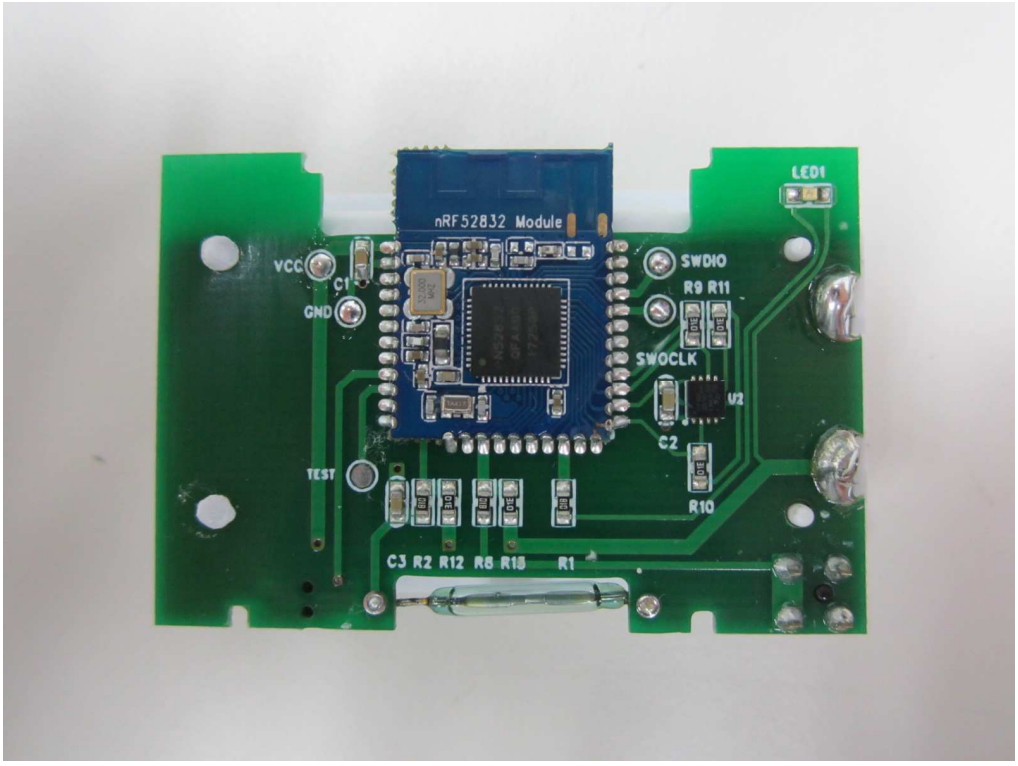
External View



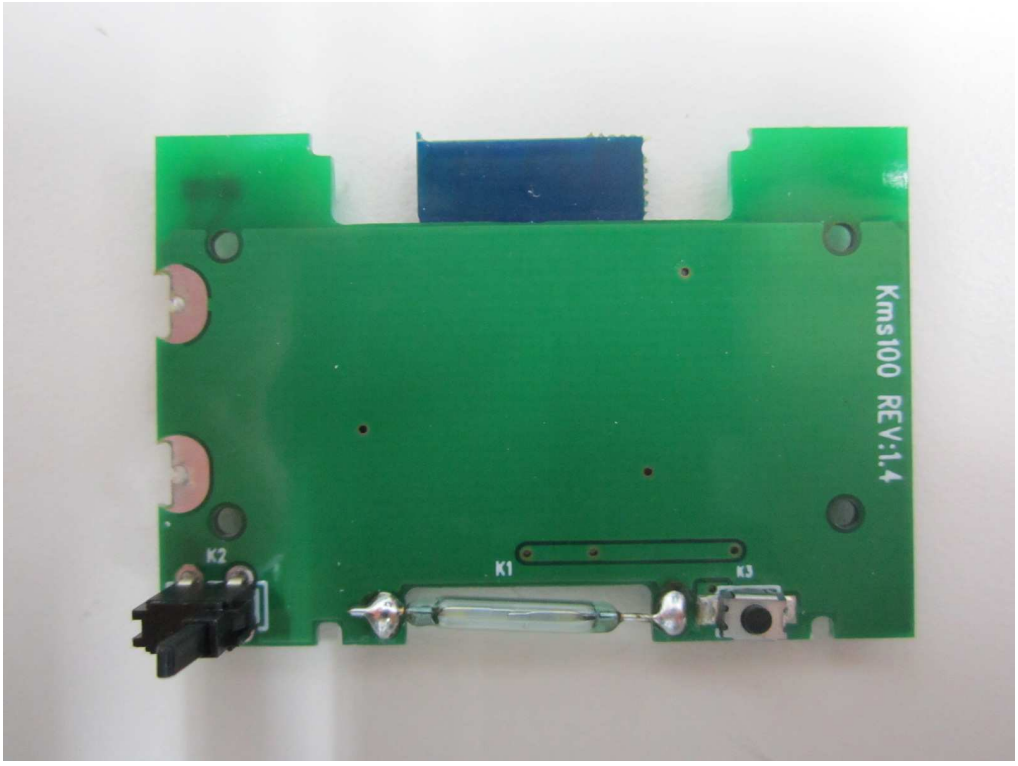
External View

Appendix 3

EUT Internal Photos



Internal View



Internal View

Appendix 4

RF Exposure Information

Maximum transmitter power:

Frequency (MHz)	Maximum peak output power (dBm)	Output power(mW)
2402	-1.19	0.76033
2440	-1.48	0.71121
2480	-1.83	0.65615

According to KDB 447498 D01:
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{}$ $f_{(GHz)}$] ⩽3.0 for 1-g SAR and ⩽7.5 for 10-g extremity SAR,[24] where
• $f_{(GHz)}$ is the RF channel transmit frequency in GHz
• Power and distance are rounded to the nearest mW and mm before calculation[25]
• The result is rounded to one decimal place for comparison
• 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

Result:

(0.76/5)*√2.402 = 0.236 <3.0

(0.71/5)*√2.440 = 0.222 <3.0

(0.66/5)*√2.480 = 0.208 <3.0

Conclusion:
No SAR is required.