

Nemko Korea Co., Ltd.

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FCC and IC EVALUATION REPORT FOR CLASS II PERMISSIVE CHANGE

Applicant :**Samsung Electronics Co., Ltd.****129,Samsung-ro, Yeongtong-gu, Suwon-si,****Gyeonggi-do, 16677, Korea****Attn. : SUNLYEONG HWANG****Dates of Issue : May 03, 2019****Test Report No. : NK-19-R-114****Test Site : Nemko Korea Co., Ltd.****FCC ID
IC****A3LSMR370
649E-SMR370****Brand Name****Samsung Electronics Co., Ltd.****Contact Person****Samsung Electronics Co., Ltd.
129,Samsung-ro, Yeongtong-gu, Suwon-si,
Gyeonggi-do, 16677, Korea
SUNLYEONG HWANG
Telephone No. : 82-10-9530-5722**

Applied Standard: FCC 47 CFR Part 15.247 and IC RSS-247 Issue 2

Classification: Digital Transmission System (DTS)

EUT Type: Galaxy Fit

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

 May 03. 2019Tested By : Yonghwan Kim
Engineer May 03. 2019Reviewed By : Seungyong Shin
Technical Manager

Revision History

Rev.	Issue Date	Revisions	Revised By
00	April 04, 2019	Initial issue	
01	April 15, 2019	Class I Permissive Change 1. Software(FVIN) change 2. Changes on PCB (Basic Report : Intial Report NK-18-R-192)	
02	May 03, 2019	Class II Permissive Change 1. Software(FVIN) change 2. Enabling new RF function by software (Basic Report : C1PC Report NK-19-R-089)	

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1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15 and IC RSS-247 Issue2.

Responsible Party :	Samsung Electronics Co., Ltd. 129,Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Contact Person :	SUNLYEONG HWANG
Manufacturer :	Samsung Electronics Co., Ltd. 129,Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

- FCC ID: A3LSMR370
- IC: 649E-SMR370
- Model: SM-R370
- HVIN: SM-R370
- Brand Name: Samsung Electronics Co., Ltd.
- EUT Type: Galaxy Fit
- Classification: Digital Transmission System (DTS)
- Applied Standard: FCC 47 CFR Part 15.247 and IC RSS-247 Issue 2
- Test Procedure(s): ANSI C63.10-2013
- Dates of Test: March 13, 2019 ~ April 14, 2019
- Place of Tests: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd. FCC ID : A3LSMR370 and IC : 649E-SMR370.**

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address 155 & 159, Osan-Ro, Mohyeon-Eup, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 16885, KOREA, REPUBLIC OF.

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18 miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014 according to §2.948.



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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
	CAB Accreditation for DOC	Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
	Canada IC Registered site	Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	KCC(RRL)Designated Lab.	Registration No. KR0026

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the transceiver which is the Bluetooth 5 module supporting LE 1M, 2M mode.

The Laptop was used to control the EUT to transmit the wanted TX channel by the testing program (RealTerm) which manufacturer supported. The Laptop was removed after controlling the EUT to transmit the wanted signal. The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.1.1 Table of test power setting

Frequency band	Mode	Power setting Level
2402~2480 MHz	LE 1M, 2M	Default

3.1.2 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
2.4 GHz	LE 1M, 2M	0	2402
		20	2442
		39	2480

3.1.3 Antenna TX mode information

Frequency band	Mode	Antenna TX mode	Support MIMO
2.4 GHz	LE 1M, 2M	■ 1TX, □ 2TX	□ Yes, ■ No

3.1.4 Additional Information Related to Testing

Enabling new RF function by software		
13.56MHz NFC	Before	After
	One 13.56MHz NFC function 1. NTAG for Wireless Charging	Two 13.56MHz NFC function 1. NTAG for Wireless Charging 2. PN553 for Tagging Communication
	NFC(PN553) was disabled by software.	NFC(PN553) is enabled by software
	FVIN : SC9	FVIN : SC9(NFC)
	The device is identical to the previous device except for enabling new RF function by software as above.	

For BLE, testing is not required because EUT does not have any changes from original device.

FVIN changes described in document 'Description of changes' doesn't affect the radio performance of BLE and there is no change of power setting level in 2400~2483.5 MHz.

All test results in basic test report (NK-19-R-089) were used in this report.

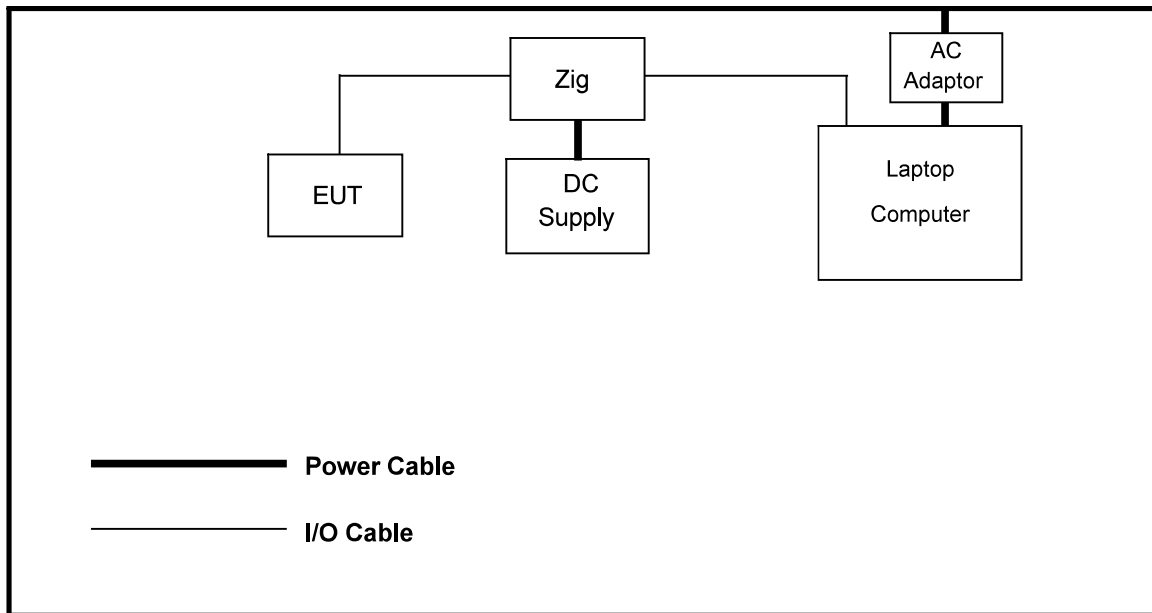
3.1.5 Table of test modes

Test Items	Mode	Modulation	Test Channel (CH)
Radiated Emissions	LE 2M	GFSK	20
6 dB Bandwidth	LE 1M, 2M		0/20/39
Peak Output Power			0/20/39
Peak Power Spectral Density			0/20/39
Conducted Spurious Emission			0/20/39
Radiated Spurious Emission, Band edge Emission			0/20/39

3.2 Support Equipment

EUT	Samsung Electronics Co., Ltd. Model : SM-R370	S/N: N/A
Laptop Computer	HP Model : G62-355TU 1.5 m shielded pin connector cable	FCC DOC S/N : CNF0489WDT
AC/DC Adapter	HP Model : PPP009D 1.5 m unshielded power cable	FCC DOC S/N : WBGSV0ACXZH162

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Electronics Co., Ltd. Galaxy Fit** FCC ID : **A3LSMR370** and IC : **649E-SMR370**.

This unit supports full qualified Bluetooth 5 with LE standard system.

Specifications:

EUT Type	Galaxy Fit
Model Name	SM-R370
Brand Name	Samsung Electronics Co., Ltd.
RF Frequency	2402 MHz ~ 2480 MHz
Peak Output Power(Conducted) E.I.R.P	-2.25 dBm -8.31 dBm
FCC Classification	Digital Transmission System (DTS)
Channel Number	40 ch
Modulation	GFSK(BLE)
Antenna Gain (peak)	-6.06 dBi
Antenna Setup	1TX / 1RX
Voltage	Operating Voltage : 3.85 Vdc Test Voltage : 3.85 Vdc
Temperature Range	-20℃ ~ +55 ℃
Size (W x H x D)	About 16.0 mm x 23.0 mm x 10.0 mm
Weight	About 24 g
HVIN (Hardware version number)	SM-R370
FVIN (Firmware Version Identification Number)	SC9(NFC)
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
Radiated Emission	15.209	RSS-GEN Issue 4 8.9	Complies	
6 dB Bandwidth	15.247(a)(2)	RSS-247 Issue 2 5.2	Complies	
Peak Output Power and E.I.R.P	15.247(b)(3)	RSS-247 Issue 2 5.4	Complies	
Power Spectral Density	15.247(e)	RSS-247 Issue 2 5.2	Complies	
Conducted Spurious Emission	15.247(d)	RSS-247 Issue 2 5.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-247 Issue 2 5.5	Complies	
Maximum Permissible Exposure	1.1307(b)	RSS-102 Issue 5	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Electronics Co., Ltd. Galaxy Fit FCC ID : A3LSMR370** and **IC : 649E-SMR370** is in compliance with Part 15.247 of the FCC Rule and RSS-247 Issue 2 of the IC specification.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: 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 antenna of the **Samsung Electronics Co., Ltd. Galaxy Fit FCC ID : A3LSMR370** and **IC : 649E-SMR370** is **permanently attached** and there are no provisions for connection to an external antenna. It complies with the requirement of §15.203.

7. DESCRIPTION OF TESTS

7.1 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.10-2013.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz) was used.

For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. For emission measurements above 1 GHz, The test equipment was placed on turntable with 1.5 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0° to 360° and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

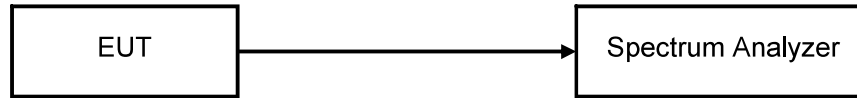
At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in ANSI 63.10-2013 section 11.12. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 1 kHz, Detector = Peak, Trace mode = max hold. Allow max hold to run for at least 50 times (1/duty cycle) traces.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Radiated Emissions Limits per 47 CFR 15.209(a) and RSS-GEN issue 4 8.9

7.2 6 dB Bandwidth

Test Setup



Test Procedure

EUTs 6 dB bandwidth is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.

RBW = 100 kHz

VBW $\geq$ 3 x RBW

Detector = Peak

Trace mode = max hold

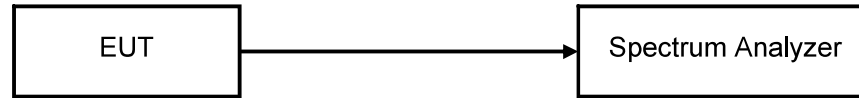
Sweep = auto couple

Allow the trace to stabilize.

The bandwidth measurement function on the spectrum analyzer is used to measure the 6 dB bandwidth.

7.3 Peak Output Power and E.I.R.P

Test Setup



Test Procedure

EUTs Maximum Peak Conducted Output Power is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

RBW = 1 MHz

VBW = 3 MHz

Span = fully encompass the DTS bandwidth

Detector = peak

Sweep time = auto couple

Trace mode = max hold

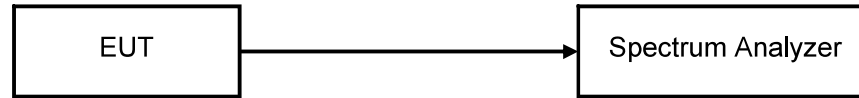
Allow the trace to stabilize.

Use peak marker function to determine the peak amplitude level.

E.I.R.P is calculated according to KDB412172 D01 Determining ERP and EIRP v01r01

7.4 Peak Power Spectral Density

Test Setup



Test Procedure

EUTs Peak Power Spectral Density is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

Center frequency = DTS channel center frequency

Span = 1.5 times the DTS channel bandwidth

RBW : 3 kHz ≤ RBW ≤ 100 kHz

VBW ≥ 3 x RBW

Detector = peak

Sweep time = auto couple

Trace mode = max hold

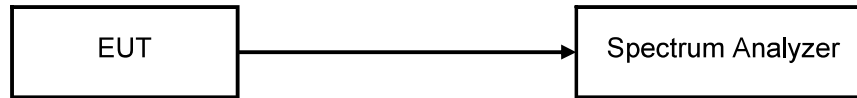
Allow the trace to stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

7.5 Conducted Spurious Emissions

Test Setup



Test Procedure

EUTs Conducted spurious emissions are measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.

Reference Level

Center frequency = DTS channel center frequency

Span $\geq 1.5 \times$ DTS bandwidth

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Detector = peak

Sweep time = auto couple

Trace mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Unwanted Emissions

Set the center frequency and span to encompass frequency range to be measured.

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Detector = peak

Sweep time = auto couple

Trace mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

8. TEST DATA

8.1 Radiated Emissions

FCC §15.209, RSS-Gen Issue 4 8.9

Result

Frequency	Reading	Pol*	Antenna Heights	Turntable	AF+CL+Amp	Result	Limit	Margin
(MHz)	(dBμV/m)	(H/V)	(cm)	Angles (°)	(dB)**	(dBμV/m)	(dBμV/m)	(dB)
30.49	49.98	V	100	292	-25.9	24.1	40.0	15.9
44.23	47.88	V	100	114	-22.8	25.1	40.0	14.9
49.72	45.04	V	100	107	-22.7	22.3	40.0	17.7
66.32	49.51	V	100	128	-25.7	23.8	40.0	16.2
787.52	42.98	V	100	156	-12.4	30.6	46.0	15.4
936.03	41.91	V	100	93	-11.2	30.7	46.0	15.3

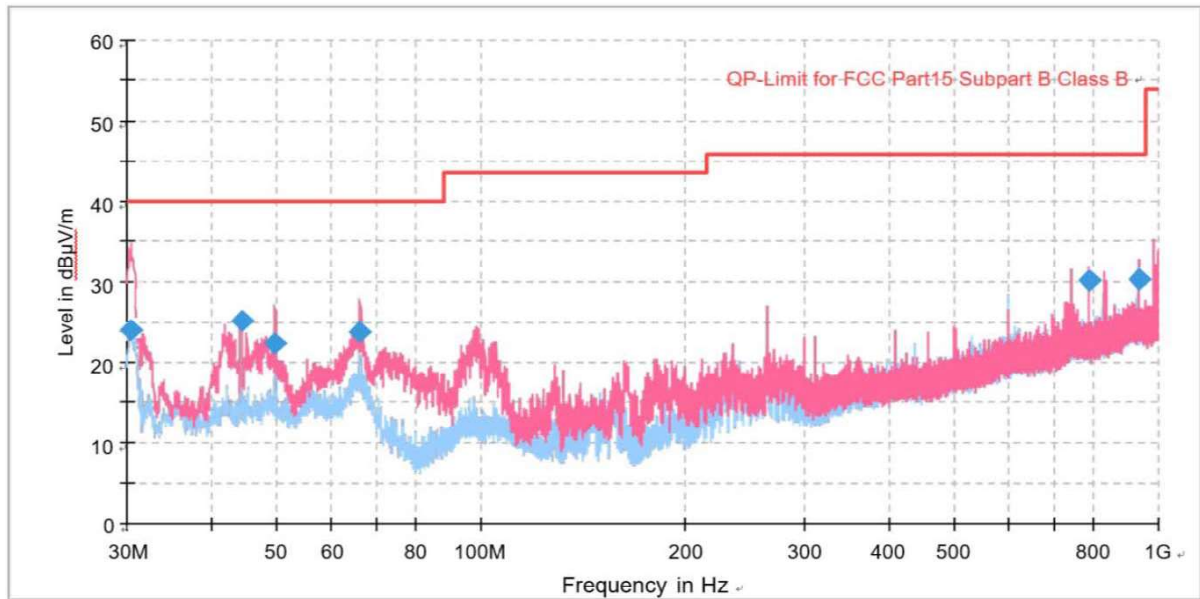
Radiated Measurements at 3meters

Notes:

1. All modes were measured and the worst-case emission was reported.
2. *Pol. H = Horizontal, V = Vertical
3. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
4. Measurements using CISPR quasi-peak mode below 1 GHz.
5. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
6. Middle channel (2402MHz) in LE 2M mode is the worst case.
7. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
8. The limit is on the FCC §15.209 and RSS-Gen Issue4 8.9

PLOTS OF EMISSIONS

Worst Case : 2402 MHz(below 1GHz) GFSK modulation



TEST DATA

8.2 6 dB Modulated Bandwidth

FCC §15.247(a)(2), IC RSS-247 Issue 2 5.2

Test Mode : Set to Lowest channel, Middle channel and Highest channel

LE 1M mode

Channel	Frequency (MHz)	6 dB modulated bandwidth (MHz)	Limit (MHz)	Margin (MHz)	99% emission bandwidth (MHz)
Lowest	2402	0.73	0.50	0.23	1.06
Middle	2442	0.73	0.50	0.23	1.06
Highest	2480	0.73	0.50	0.23	1.06

LE 2M mode

Channel	Frequency (MHz)	6 dB modulated bandwidth (MHz)	Limit (MHz)	Margin (MHz)	99% emission bandwidth (MHz)
Lowest	2402	0.73	0.50	0.23	2.07
Middle	2442	0.73	0.50	0.23	2.08
Highest	2480	0.73	0.50	0.23	2.07

PLOTS OF EMISSIONS

LE 1M mode

6 dB Bandwidth, Lowest Channel (2402 MHz)



6 dB Bandwidth, Middle Channel (2442 MHz)



PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (2480 MHz)



LE 2M mode

6 dB Bandwidth, Lowest Channel (2402 MHz)



PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (2442 MHz)



6 dB Bandwidth, Highest Channel (2480 MHz)



TEST DATA

8.3 Peak Output Power and E.I.R.P.

FCC §15.247(b)(3), IC RSS-247 Issue 2 5.4

Test Mode : Set to Lowest channel, Middle channel and Highest channel

LE 1M mode

Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)
Lowest	2402	-2.35	30.00	-8.41	36.00
Middle	2442	-2.34	30.00	-8.40	36.00
Highest	2480	-2.68	30.00	-8.74	36.00

LE 2M mode

Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)
Lowest	2402	-2.25	30.00	-8.31	36.00
Middle	2442	-2.51	30.00	-8.57	36.00
Highest	2480	-2.81	30.00	-8.87	36.00

Note:

The following formular was used for spectrum offset:

Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

*) E.I.R.P was calculated by following equation according to KDB412172 D01 Determining ERP and EIRP v01r01.

$$E.I.R.P = P_T + G_T - L_C$$

P_T = Peak outputpower (dBm)

G_T = Gain of the transmitting antenna in dBi, Peak antenna gain is -6.06dBi.

L_C = Signal attenuation in the connecting cable between the transmitter and antenna in dB. This factor of an integral antenna is negligible.