

Produkte
Products

Prüfbericht-Nr.: <i>Test Report No.:</i>	50184939 001	Auftrags-Nr.: <i>Order No.:</i>	144196182	Seite 1 von 18 <i>Page 1 of 18</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	21.09.2018		
Auftraggeber: <i>Client:</i>	Port Ease Limited Unit 1703, 17/F., Kwun Tong View, 410 Kwun Tong Road, Kwun Tong, Hong Kong				
Prüfgegenstand: <i>Test item:</i>	Bluetooth Low Energy Module				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	ABLE42M1				
Auftrags-Inhalt: <i>Order content:</i>	FCC/IC Certification				
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C; RSS-Gen Issue 5; RSS-247 Issue 2; RSS-102 Issue 5; ANSI C63.10-2013				
Wareneingangsdatum: <i>Date of receipt:</i>	02.10.2018				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000816745-001				
Prüfzeitraum: <i>Testing period:</i>	10.10.2018 – 15.10.2018				
Ort der Prüfung: <i>Place of testing:</i>	Hong Kong				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:		kontrolliert von / reviewed by:			
01.11.2018	Joey Leung Project Manager	01.11.2018			Sharon Li Unit Senior Manager
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges: FCC ID: 2ARFOABLE42M1 <i>Others:</i> IC: 24399-ABLE42M1					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
<p>* 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</p> <p>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</p>					
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>					

Table of Content

	Page
Cover Page	1
Table of Content.....	2
Product information.....	4
Manufacturers declarations	4
Product function and intended use.....	4
Submitted documents	4
Independent Operation Modes	4
Related Submittal(s) Grants.....	4
Remark	4
Test Set-up and Operation Mode.....	5
Principle of Configuration Selection	5
Test Operation and Test Software	5
Special Accessories and Auxiliary Equipment	5
Countermeasures to achieve EMC Compliance	5
Test Methodology	6
Radiated Emission	6
Field Strength Calculation	6
Test Setup Diagram	7
Test Facility	9
Test Laboratory Information	9
List of Test and Measurement Instruments.....	10
Measurement Uncertainty	11
Results FCC Part 15 – Subpart C / RSS-247 Issue 2.....	12
FCC 15.203 – Antenna Requirement 1	Pass 12
FCC 15.204 – Antenna Requirement 2	Pass 12
RSS-Gen 6.3 – External Control.....	Pass 12
RSS-Gen 8.3 – Antenna Requirement	Pass 12
FCC 15.207 / RSS-Gen 8.8 – Conducted Emission on AC Mains	Pass 13
FCC 15.247 (a)(2) / RSS-247 5.2 – 6dB Bandwidth Measurement.....	Pass 14
RSS-Gen 6.6 – Occupied Bandwidth.....	Pass 14
FCC 15.247 (b)(3) / RSS-247 5.4 – Maximum Peak Conducted Output Power	Pass 15
FCC 15.247 (e) / RSS-247 5.2 – Power Spectral Density.....	Pass 15
FCC 15.247 (d) / RSS-247 5.5 – Spurious Conducted Emissions	Pass 16
FCC 15.205 / RSS-Gen 8.9 – Radiated Emissions in Restricted Frequency Bands.....	Pass 17

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Appendix 1 – Test protocols.....	19 pages
Appendix 2 – Test setup	3 pages
Appendix 3 – EUT External Photos.....	2 pages
Appendix 4 – EUT Internal Photos	2 pages
Appendix 5 – RF exposure information.....	2 pages

Product information

Manufacturers declarations

	BLE Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	Integral PCB Antenna
Antenna gain (dBi)	0 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Operating voltage	V _{oper} : 1.8 ~ 3.3 VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a Bluetooth Low Energy module.

FCC ID: 2ARFOABLE42M1 / IC: 24399-ABLE42M1

Models	Product description
ABLE42M1	Bluetooth Low Energy Module

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation mode is transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

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

- A DC regulated power supply provided by TÜV Rheinland Hong Kong Ltd. was used to supply 3.0VDC during testing.

Countermeasures to achieve EMC Compliance

- Nil.

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 3m 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.

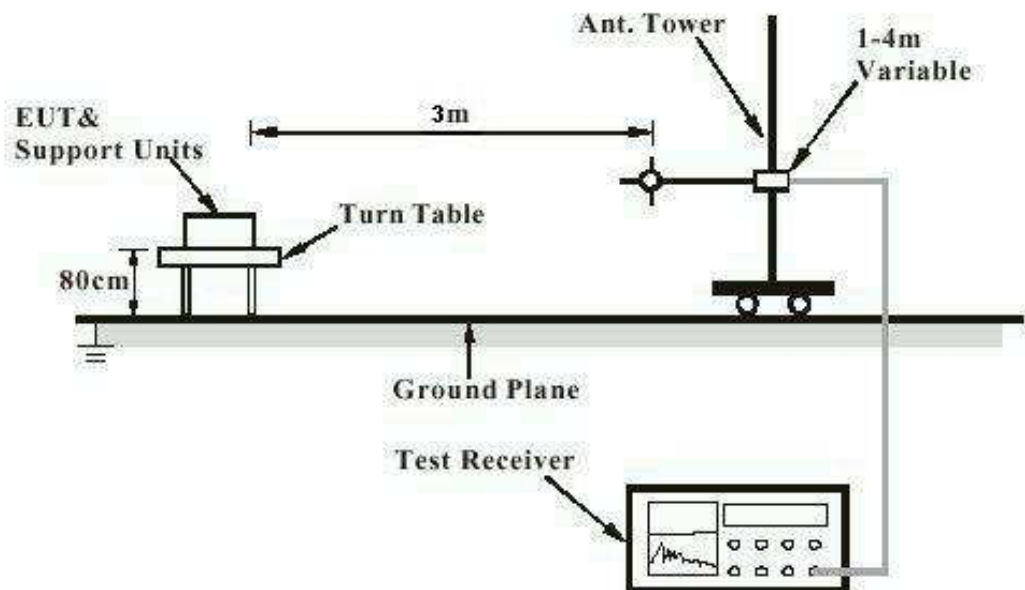
FA = Filter Attenuation Factor in dB.

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)

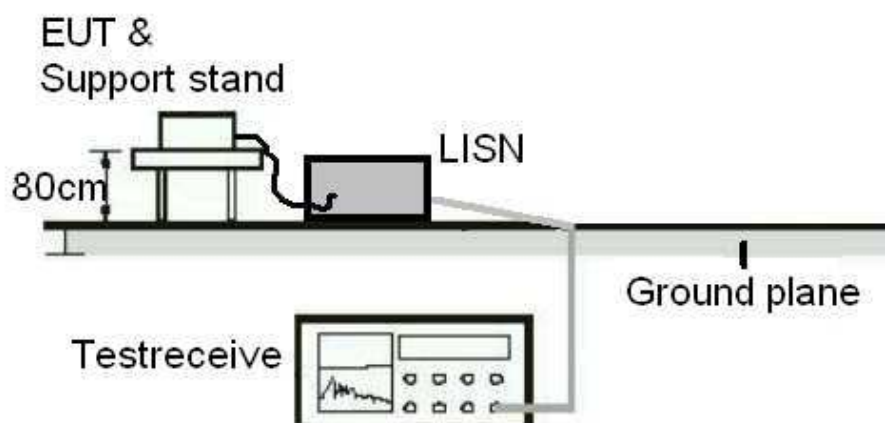
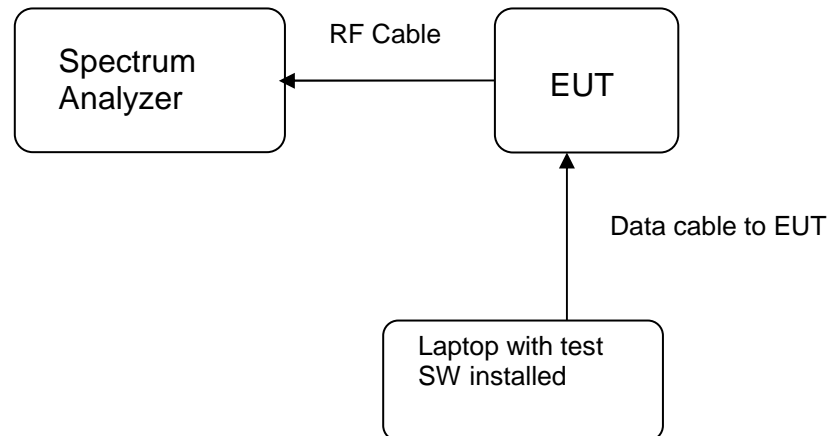


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



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

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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

Industry Canada

The 10m Semi-anechoic chamber used by TÜV Rheinland Hong Kong Ltd at Hong Kong Productivity Council has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

Test Site Registration Number : 4780A-1

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	23 Apr 2018	23 Apr 2019
Test Receiver	R & S	ESU40	100190	12 Jun 2018	12 Jun 2019
Bi-conical Antenna	R & S	HK116	100241	21 Mar 2018	21 Mar 2020
Log Periodic Antenna	R & S	HL223	841516/017	22 Mar 2018	22 Mar 2020
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	A2803 #0001	11 Dec 2017	11 Dec 2019
Active Loop Antenna	EMCO	6502	9107-2651	30 Oct 2017	30 Oct 2018
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	Nil	17 May 2018	17 May 2019
Double-Ridged Waveguide Horn	EMCO	3116	00109210	05 Oct 2018	04 Oct 2020
Double-Ridged Waveguide Horn	EMCO	3117	00094998	30 Aug 2018	29 Aug 2020
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	18 Jul 2018	17 Jul 2020
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	168	29 Jan 2018	29 Jan 2019
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	30 Oct 2017	30 Oct 2019
High Frequency Cable	Pasternack	PE3VNA4001-3M	20160707C02493	29 Jan 2018	29 Jan 2019
Horn Antenna	EMCO	3115	9002-3347	28 Mar 2018	28 Mar 2020

AC Mains Conducted Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Test Receiver	R & S	ESU40	100190	12 Jun 2018	12 Jun 2019
LISN	R & S	ENV216	102170	31 Jul 2018	31 Jul 2019
Double Shield Cable	Huber+ Suhner	RG223/U-01	None	18 May 2017	18 May 2019

Radio Test

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Spectrum Analyzer	R & S	FSP30	100610	03 May 2018	02 May 2019

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is ± 2.42 dB.

The estimated combined standard uncertainty for radiated emissions measurements is ± 4.81 dB (9 kHz to 30 MHz) and ± 4.62 dB (30 MHz to 200 MHz) and ± 5.67 dB (200 MHz to 1000 MHz) and is ± 5.07 dB (1 GHz to 8.2 GHz) and ± 4.58 dB (8.2 GHz to 12.4 GHz) and ± 4.78 dB (12.4 GHz to 18 GHz)

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

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 / RSS-247 Issue 2

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: Integral PCB antenna b) Manufacturer and model no: N/A c) Peak Gain: 0dBi	
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		Pass
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:	Pass	

RSS-Gen 6.3 – External Control		Pass
IC Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the limits prescribed in the applicable RSS.	
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	Pass	

RSS-Gen 8.3 – Antenna Requirement		Pass
IC Requirement:	When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.	
Results:	a) Antenna type: Integral PCB antenna b) Manufacturer: N/A c) model no: N/A d) Gain with reference to an isotropic radiator: 0 dBi	
Verdict:	Pass	

FCC 15.207 / RSS-Gen 8.8 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.10-2013 Test date : 12.10.2018 Mode of operation : TX mode Port of testing : AC Mains input port of power supply Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.207(a)						
Results: Pass						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0.15 – 0.5	No peak found	---	---	66 - 56	56 - 46	Pass
> 0.5 – 5	No peak found	---	---	56	46	Pass
> 5 – 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0.15 – 0.5	No peak found	---	---	66 - 56	56 - 46	Pass
> 0.5 – 5	No peak found	---	---	56	46	Pass
> 5 – 30	No peak found	---	---	60	50	Pass
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1.						

FCC 15.247 (a)(2) / RSS-247 5.2 – 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 : 11.10.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.3VDC Temperature : 23°C 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	2401.658	2402.354	696
2440	2439.670	2440.360	690
2480	2479.652	2480.360	708

RSS-Gen 6.6 – Occupied Bandwidth			Pass
FCC / IC Requirement : N/A			
Test Specification : RSS-Gen Test date : 12.10.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%			
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.			
Frequency (MHz)	Left (MHz)	Right (MHz)	99% bandwidth (MHz)
2402	2401.454	2402.570	1.116
2440	2439.370	2440.648	1.278
2480	2478.790	2480.960	2.170

FCC 15.247 (b)(3) / RSS-247 5.4 – Maximum Peak Conducted 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 : 12.10.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2402	-0.42	1 / 30.0	Pass
2440	-0.56	1 / 30.0	Pass
2480	-0.83	1 / 30.0	Pass

FCC 15.247 (e) / RSS-247 5.2 – 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 : 12.10.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-0.54	8.0	Pass
2440	-0.72	8.0	Pass
2480	-0.95	8.0	Pass

FCC 15.247 (d) / RSS-247 5.5 – Spurious Conducted Emissions					Pass
Test Specification : ANSI C63.10 – 2013 Test date : 12.10.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.3VDC Temperature : 23°C 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	2372.000	-51.75	-0.54	51.21	Pass
2440	2384.000	-53.04	-0.72	52.32	Pass
2480	2512.000	-50.22	-0.95	49.27	Pass

FCC 15.205 / RSS-Gen 8.9 – Radiated Emissions in Restricted Frequency Bands			Pass
Test Specification : ANSI C63.10 – 2013 Test Date : 12.10.2018 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%			
FCC Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).			
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Simultaneous transmission was investigated and no new emissions were found. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.			
Mode: 2402MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2390.000	52.6	74.0 / PK	
2390.000	39.2	54.0 / AV	
4804.461	52.6	74.0 / PK	
4804.461	39.2	54.0 / AV	
Mode: 2402 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
143.937	43.3	43.5 / QP	
2390.000	52.3	74.0 / PK	
2390.000	31.0	54.0 / AV	
4804.461	51.9	74.0 / PK	
4804.461	38.0	54.0 / AV	
Mode: 2440 MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4879.463	52.2	74.0 / PK	
4879.463	37.9	54.0 / AV	
Mode: 2440 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4879.471	52.1	74.0 / PK	
4879.471	38.9	54.0 / AV	

Mode: 2480MHz TX			Vertical Polarization		
Freq MHz		Level dBuV/m	Limit/ Detector dBuV/m		
2483.500		57.1	74.0 / PK		
2483.500		36.2	54.0 / AV		
4959.467		51.2	74.0 / PK		
4959.467		38.2	54.0 / AV		
Mode: 2480 MHz TX			Horizontal Polarization		
Freq MHz		Level dBuV/m	Limit/ Detector dBuV/m		
2483.500		62.2	74.0 / PK		
2483.500		40.1	54.0 / AV		
4959.467		52.2	74.0 / PK		
4959.467		38.7	54.0 / AV		