

Produkte
Products

Prüfbericht - Nr.: 14045647 001		Seite 1 von 18 Page 1 of 18	
<i>Test Report No.:</i>			
Auftraggeber: <i>Client:</i>	Megabyte Limited Unit 507, Building 12W, No. 12 Science Park West Avenue Hong Kong Science Park, Shatin, N.T., Hong Kong		
Gegenstand der Prüfung: <i>Test Item:</i>	UHF Mobile RFID Reader		
Bezeichnung: <i>Identification:</i>	T8-01-MB T8-01-39, T8-01-PH	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	A000386196-002	Eingangsdatum: <i>Date of Receipt:</i>	03.02.2016
Prüfort: <i>Testing Location:</i>	TÜV Rheinland Hong Kong Ltd. 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>	Test samples are not damaged and suitable for testing.		
Prüfgrundlage: <i>Test Specification:</i>	FCC Part 15 Subpart C ANSI C63.10-2013		
Prüfergebnis: <i>Test Results:</i>	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Hong Kong Ltd. 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong		
geprüft/ tested by:		kontrolliert/ reviewed by:	
23.12.2016 Benny Lau Senior Project Manager		23.12.2016 Sharon Li Department Manager	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges: Other Aspects		FCC ID: XEK-MTRAYT8 This device is a composite device. This report contains the test result of the Bluetooth Basic Rate transceiver portion.	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
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. This test report 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 safety mark on this or similar products.			

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK; Pi/4 DQPSK; 8 DPSK
Number of channels	79
Channel separation	1 MHz
Type of antenna	Integral Chip Antenna
Antenna gain (dBi)	1.9 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	Yes
Nominal voltage	100-240VAC/ 3.7VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a mobile RFID reader. It is a compact NFC and UHF RFID reader with Bluetooth and WIFI connectivity.

The manufacturer declared that the model: T8-01-39 and T8-01-PH are identical to the model T8-01-MB except the logo plate.

FCC ID: XEK-MTRAYT8

Models	Product description
T8-01-MB T8-01-39, T8-01-PH	UHF Mobile RFID Reader

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

This device is a composite device. This is a single application for certification of the Bluetooth Basic Rate transceiver.

The RFID transmitter portion is authorized under the certification procedure (refer to test report 14045645 001 issued by TÜV Rheinland HK Ltd on 23.12.2016).

The NFC portion is authorized under the certification procedure (refer to test report 14045648 001 issued by TÜV Rheinland HK Ltd on 23.12.2016).

The other Bluetooth portion is authorized under the certification procedure (refer to test report 14045646 001 and 14047147 001 issued by TÜV Rheinland HK Ltd on 23.12.2016).

The WIFI portion is authorized under the certification procedure (refer to test report 14045649 001 and 14047148 001 and 14047149 001 issued by TÜV Rheinland HK Ltd on 23.12.2016).

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

The product has been tested together with the following additional accessories:

- AC-DC adaptor Model: EA1024AR-050 Input: 100-240 VAC 50/60 Hz; Output: 5.0VDC 2A)
(Provided by the applicant)

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. The radiated emission measurements of the receiver part were performed according to the procedures in ANSI C63.4-2014.

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:

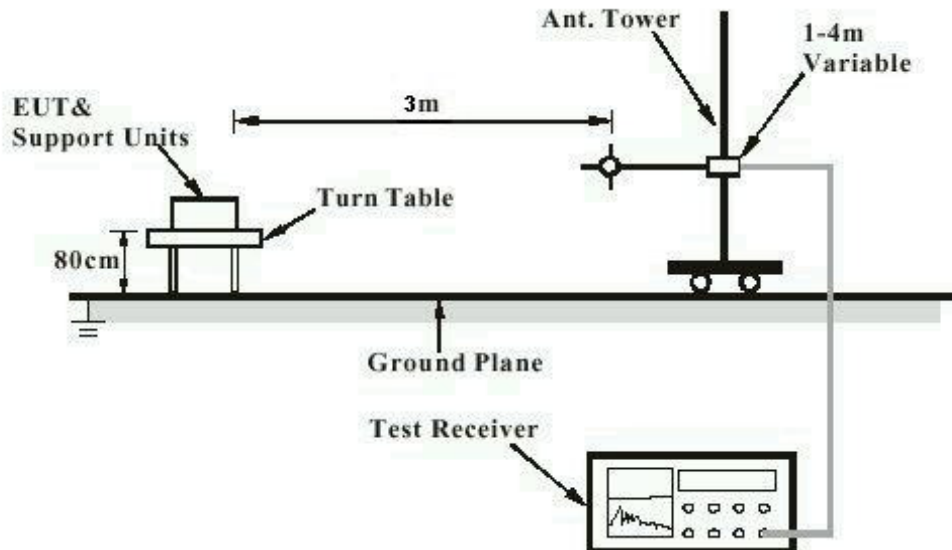
$$FS = R + AF + CF + FA - PA$$

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)

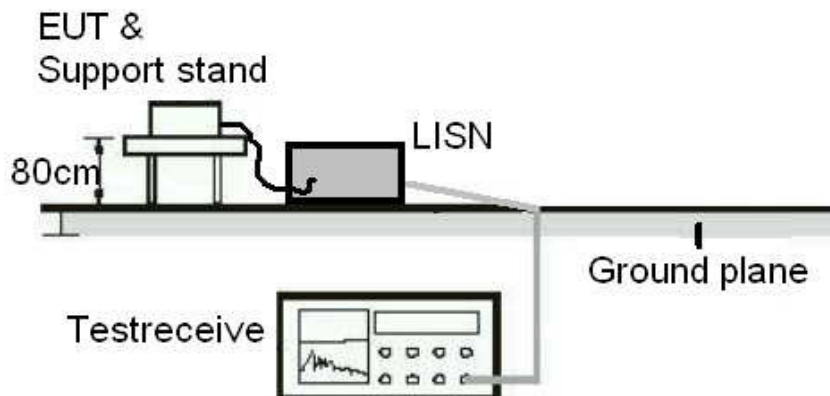
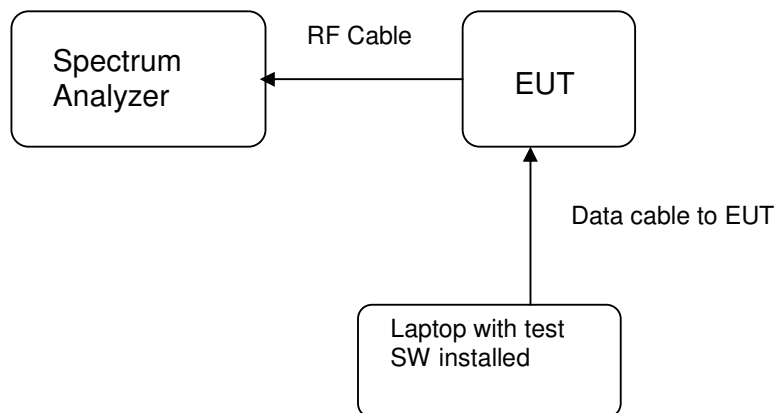


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



List of Test and Measurement Instruments

Hong Kong Productivity Council (FCC Registration number: 90656)

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	25-Apr-16	25-Apr-17
New Fully Anchoic Chamber	TDK	N/A	19-Apr-16	19-Apr-17
Cable	Hubersuhner	SUCOFLEX 104	31-Mar-16	31-Mar-18
Test Receiver	R & S	ESU26	7-Dec-15	7-Dec-16
Bi-conical Antenna	R & S	HK116	1-Sep-15	1-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	1-Sep-17
Coaxial cable	Harbour	LL335	10-Jun-16	10-Jun-18
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-16	18-Jul-18
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17
Horn Antenna	EMCO	3115	26-Aug-15	26-Aug-17
Active Loop Antenna	EMCO	6502	27-Oct-16	27-Oct-17

AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESU40	26-Jul-16	26-Jul-17
RF Voltage Probe	Schwarzbeck	TK9416	11-Feb-16	11-Feb-17
LISN	R&S	ESH3-Z5	15-Jun-16	15-Jun-17
Double Shield Cable	Radiall	RG142	14-Sep-15	14-Sep-17
Pulse Limiter	R&S	ESH3-Z2	3-Jun-16	3-Jun-18

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Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	12-Jan-15	12-Jan-2017

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 3.43\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (above 1GHz).

The estimated combined standard uncertainty for antenna conducted emission is $\pm 1.56\text{dB}$

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

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 FR4 PCB antenna b) Manufacturer and model no: WIESON GY197HC030-002 c) Peak Gain: 1.9 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						Pass
Test Specification : ANSI C63.10 – 2013 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	0.151	51.9	35.0	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	0.151	51.8	35.0	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass

Results:	<p>Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. The worst cases is found in GFSK and 1Mbps.</p> <p>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.</p>
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FCC 15.247 (b)(1) – Peak Output Power			Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 120VAC and/ or 3.7VDC Temperature : 23°C Humidity : 50%			
FCC/ IC Requirement : For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts.			
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. The worst cases is found in GFSK and 1Mbps. For test protocols please refer to Appendix 1.			
Frequency (MHz)	Maximum peak output power (dBm)	Limit (dBm)	Verdict
2402	6.85	30	Pass
2441	8.02	30	Pass
2480	8.90	30	Pass

FCC 15.247 (a) – 20 dB Bandwidth			Pass
FCC/ IC Requirement : N/A			
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 120VAC and/ or 3.7VDC 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. The worst cases is found in 8DPSK and 3Mbps. For test protocols refer to Appendix 1.			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	2401.340	2402.650	1.31
2441	2440.330	2441.650	1.32
2480	2479.330	2480.650	1.32

FCC 15.247(a)(1) – Carrier Frequency Separation			Pass
FCC/ IC Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.			
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode (hopping on) Port of testing : Temporary antenna port Supply voltage : 120VAC and/ or 3.7VDC Temperature : 23°C Humidity : 50%			
Results: For test Results plots refer to Appendix 1.			
Channel Separation (kHz)	Limit (kHz)	Verdict	
996.000	880	Pass	

FCC 15.247 (a)(1)(iii) – Number of hopping channels			Pass
FCC/ IC Requirement: Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at least 15 hopping frequencies.			
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode (hopping on) Port of testing : Temporary antenna port Supply voltage : 120VAC and/ or 3.7VDC Temperature : 23°C Humidity : 50%			
Results: For test Results plots refer to Appendix 1.			
No. of hopping channels	Limit	Verdict	
79	15	Pass	

FCC 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)		Pass
FCC/ IC Requirement: Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.		
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode (hopping on) Port of testing : Temporary antenna port Supply voltage : 120VAC and/ or 3.7VDC Temperature : 23°C Humidity : 50%		
Results: Time period calculation = $0.4 \times 79 = 31.6\text{s}$ Dwell time = $108 \times 2.89 \times 10^{-3} = 0.312\text{ s}$ $\leq 0.4\text{ s}$ For test protocols please refer to Appendix 1.		
Verdict: Pass		

FCC 15.247 (a) – Hopping Sequence		Pass
FCC Requirement: The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.		
The EUT complies with the Bluetooth RF specifications which is proven to fulfill this requirement. Please refer to the Bluetooth standard for detail		

FCC 15.247 (a) – Equal Hopping Frequency Use		Pass
FCC Requirement: Each of the transmitter's hopping channels is used equally on average.		
The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.		
The EUT complies with the Bluetooth RF specifications which is proven to fulfill this requirement. Please refer to the Bluetooth standard for detail.		

FCC 15.247 (a) – Receiver Input Bandwidth	Pass
FCC Requirement: The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.	
The EUT complies with the Bluetooth RF specifications which is proven to fulfill this requirement. Please refer to the Bluetooth standard for detail.	

FCC 15.247 (a) – Receiver Hopping Capability	Pass
FCC Requirement: The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.	
The EUT complies with the Bluetooth RF specifications which is proven to fulfill this requirement. Please refer to the Bluetooth standard for detail.	

FCC 15.247 (d) – Spurious Conducted Emissions					Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 120VAC and/ or 3.7VDC 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 packet types. There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	23080.000	-19.50	6.84	26.34	Pass
2441	24112.000	-19.02	7.97	26.99	Pass
2480	24592.000	-17.78	8.89	26.67	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands			Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Enclosure Supply voltage : 120VAC and/ or 3.7VDC 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. The worst cases is found in GFSK and 1Mbps. 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: 2402 MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
182.029	29.2	43.5 / QP	
2377.436	47.94	74.0 / PK	
2378.077	35.56	54.0 / AV	
4804.256	63.52	74.0 / PK	
4803.952	38.76	54.0 / AV	
Mode: 2402 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
183.816	38.7	43.5 / QP	
2378.077	48.53	74.0 / PK	
2377.949	34.47	54.0 / AV	
4804.407	59.17	74.0 / PK	
4803.990	34.41	54.0 / AV	
Mode: 2441 MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4882.372	60.79	74.0 / PK	
4881.955	36.03	54.0 / AV	

Mode: 2441 MHz TX			Horizontal Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
4882.173		59.39		74.0 / PK	
4881.997		34.63		54.0 / AV	
Mode: 2480 MHz TX			Vertical Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
2484.029		48.32		74.0 / PK	
2484.029		34.06		54.0 / AV	
4960.304		63.57		74.0 / PK	
4960.016		38.81		54.0 / AV	
Mode: 2480 MHz TX			Horizontal Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
182.070		36.9		43.5 / QP	
784.015		40.0		46.0 / QP	
2483.500		53.74		74.0 / PK	
2483.500		41.98		54.0 / AV	
4959.551		59.56		74.0 / PK	
4959.952		34.80		54.0 / AV	

Remark: Average value is determined from the worst case duty cycle correction factor.

FCC 15.35 (c) – Worst Case Duty Factor

ON time of a pulse	2.89 ms	See Appendix 1
Number of pulse found in 100ms	2	See Appendix 1
Duty cycle factor = $20 \times \log (\text{on time of 1 pulse} \times \text{no. of pulse in 100ms}) / 100\text{ms}$ = -24.76 dB		