

FCC Test Report

FCC ID : COFMT-52
Equipment : 802.11b/g/n + BT 4.2 IOT Module
Brand Name : USI
Model Name : MT-52
Applicant / Manufacturer : Universal Global Scientific Industrial Co., Ltd
141, Lane 351, Sec. 1, Taiping Road., Tsaotuen,
Nantou 54261, Taiwan
Standard : 47 CFR FCC Part 15.247

The product was received on Aug. 07, 2018, and testing was started from Aug. 08, 2018 and completed on Aug. 15, 2018. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Allen Lin

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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PHOTOGRAPHS OF EUT V01



History of this test report

Report No.	Version	Description	Issued Date
FR880224AL	01	Initial issue of report	Sep. 14, 2018



Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	FCC 15.203
3.1	15.207	AC Power-line Conducted Emissions	PASS	FCC 15.207
3.2	15.247(a)	DTS Bandwidth	PASS	≥500kHz
3.3	15.247(b)	Maximum Conducted Output Power	PASS	Power [dBm]:30
3.4	15.247(e)	Power Spectral Density	PASS	PSD [dBm/3kHz]:8
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	Non-Restricted Bands: >30 dBc
3.6	15.247(d)	Emissions in Restricted Frequency Bands	PASS	Restricted Bands: FCC 15.209

Reviewed by: Jackson Tsai

Report Producer: Debby Hung

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number
2400-2483.5	LE	2402-2480	0-39 [40]

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	BT-LE(1Mbps)	1.0	1TX

Note:

- ♦ Bluetooth LE uses a GFSK (1Mbps) modulation for DSSS.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	USI	MT-52	PCB antenna	mini Murata	1.71

For 2.4GHz function:

For IEEE 802.11 b/g/ n mode (1TX/1RX)

Ant. 1 (port 1) could transmit/receive simultaneously.

For BT function:

For IEEE 802.15.1 Bluetooth mode (1TX/1RX)

Ant. 1 (port 1) could transmit/receive simultaneously.

1.1.3 EUT Information

Operational Condition	
EUT Power Type	From Host system
EUT Function	<input checked="" type="checkbox"/> Point-to-multipoint <input type="checkbox"/> Point-to-point
Type of EUT	
<input checked="" type="checkbox"/>	Stand-alone
<input type="checkbox"/>	Combined (EUT where the radio part is fully integrated within another device)
	Combined Equipment - Brand Name / Model No.: ...
<input type="checkbox"/>	Plug-in radio (EUT intended for a variety of host systems)
	Host System - Brand Name / Model No.: ...
<input type="checkbox"/>	Other:

1.1.4 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
BT-LE(1Mbps)	0.608	2.161	380u	3k

1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ◆ 47 CFR FCC Part 15
- ◆ ANSI C63.10-2013
- ◆ KDB 558074 D01 v04

1.3 Testing Location Information

Testing Location		
<input checked="" type="checkbox"/>	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL : 886-3-327-3456 FAX : 886-3-327-0973
Test site Designation No. TW1190 with FCC.		
<input type="checkbox"/>	JHUBEI	ADD : No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County, Taiwan (R.O.C.) TEL : 886-3-656-9065 FAX : 886-3-656-9085
Test site Designation No. TW0006 with FCC.		

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-HY	Randy	23.3°C / 63%	09/Aug/2018
Radiated	03CH02-HY	Lego	24°C / 61%	15/Aug/2018
AC Conduction	CO04-HY	Jerry	22.8°C / 56%	08/Aug/2018

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	3.0 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.9 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.3 dB	Confidence levels of 95%
Temperature	0.7 °C	Confidence levels of 95%
Humidity	4 %	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Condition

RF Conducted	Abbreviation	Remark
TnomVnom	Tnom	20°C
-	Vnom	3.3V

2.2 Test Channel Mode




Test Software Version	WCN_Combo_tool #1-ACSIP
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Mode	Power Setting
BT-LE(1Mbps)	-
2402MHz	Default
2440MHz	Default
2480MHz	Default

2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral
Operating Mode	CTX
1	USB mode

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests			
Tests Item	Emissions in Restricted Frequency Bands		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
Operating Mode < 1GHz	CTX		
1	USB mode		
Operating Mode > 1GHz	CTX		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			
Worst Planes of EUT			V

2.4 Support Equipment

Support Equipment – RF Conducted				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5410	R33002 / DOC
2	Adapter for NB	DELL	HA65NM130	R35737 / DOC
3	DC Power Supply	GW	GPS-3030DD	-

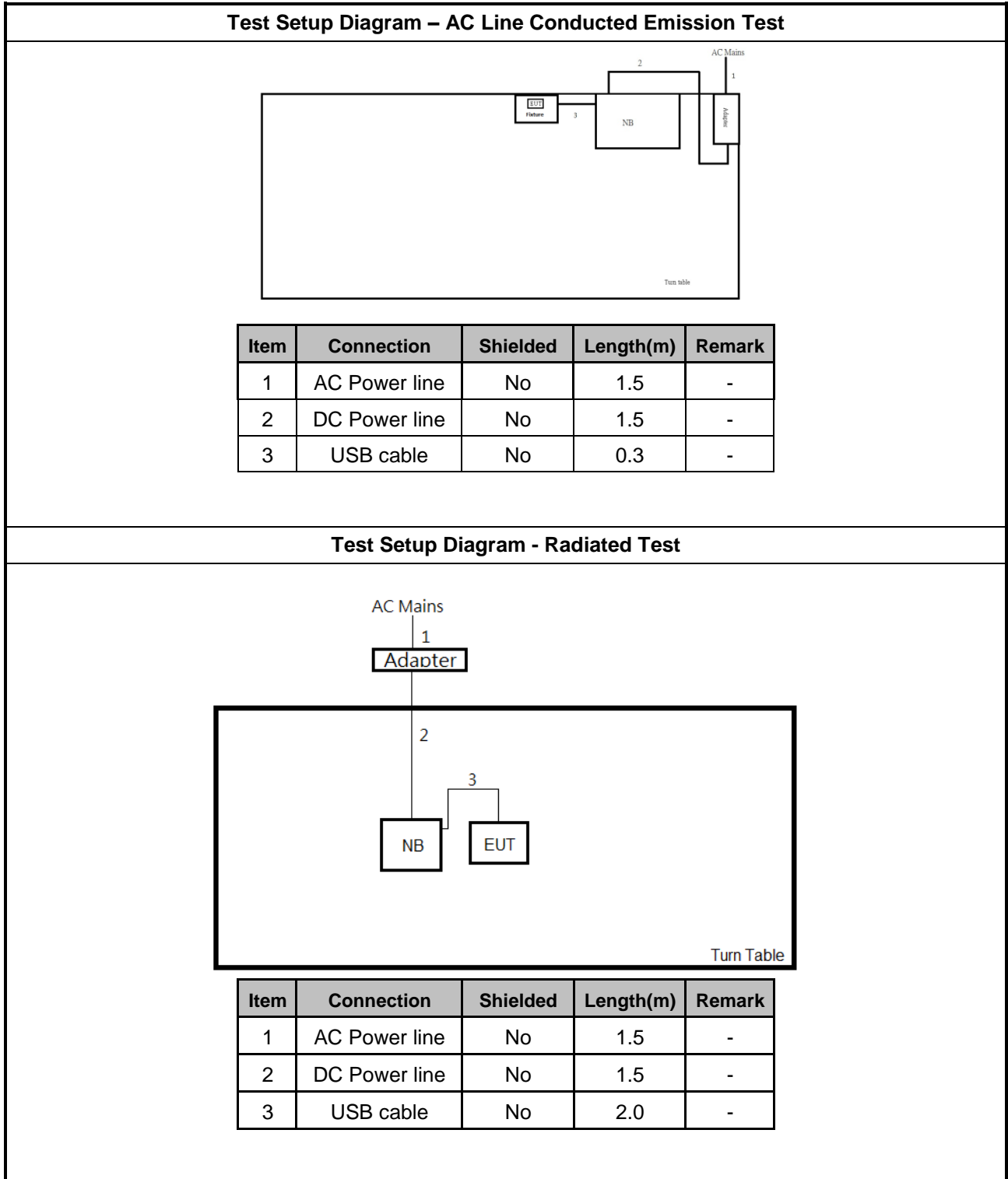
Support Equipment – Radiated Emission				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5520	-
2	AC adapter	DELL	LA65NS2-01	-
3	Fixture	-	-	-

Note.Support equipment No.3 was provided by customer.

Support Equipment – AC Conduction				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5520	-
2	AC adapter	DELL	LA65NS2-01	-
3	Fixture	-	-	-

Note.Support equipment No.3 was provided by customer.

2.5 Test Setup Diagram



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

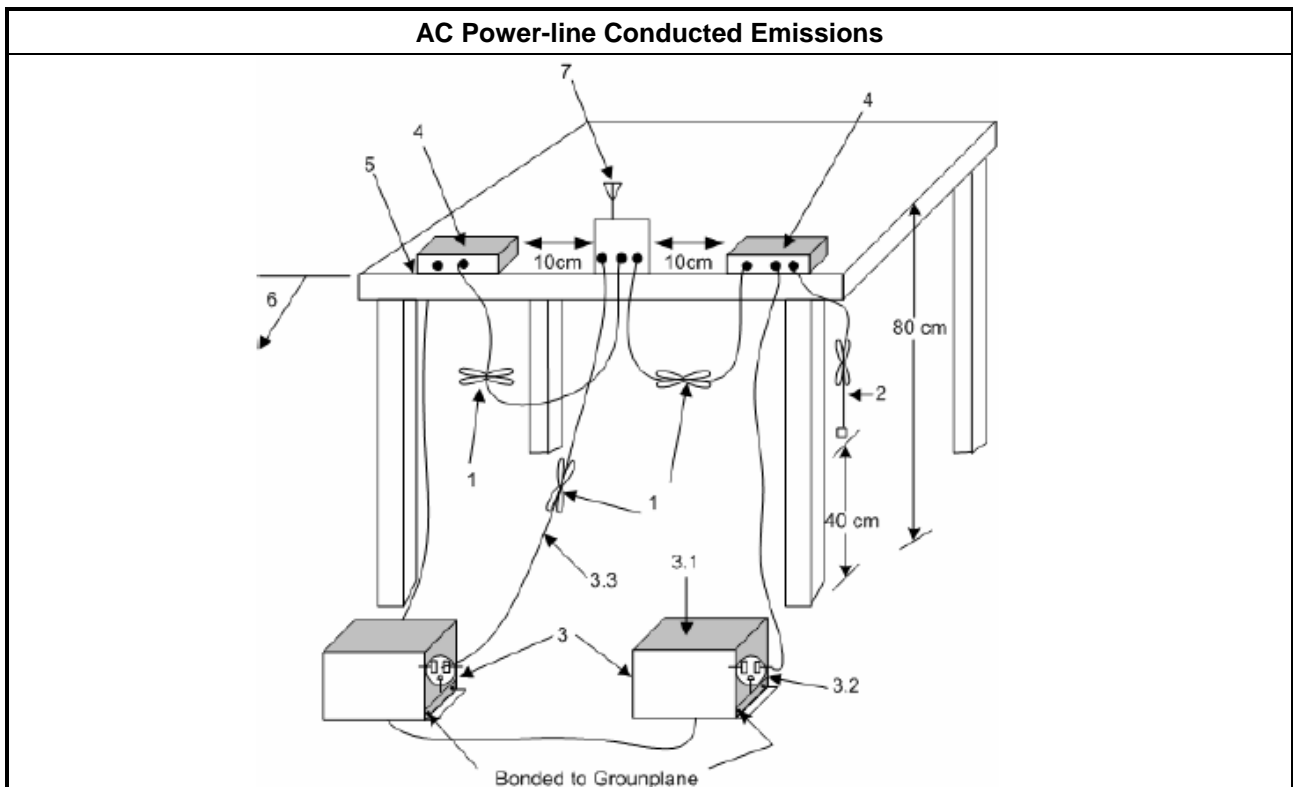
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method
<ul style="list-style-type: none"> Refer as ANSI C63.10-2013, clause 6.2 foray power-line conducted emissions.

3.1.4 Test Setup





3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit
Systems using digital modulation techniques:
<ul style="list-style-type: none"> ▪ 6 dB bandwidth \geq 500 kHz.

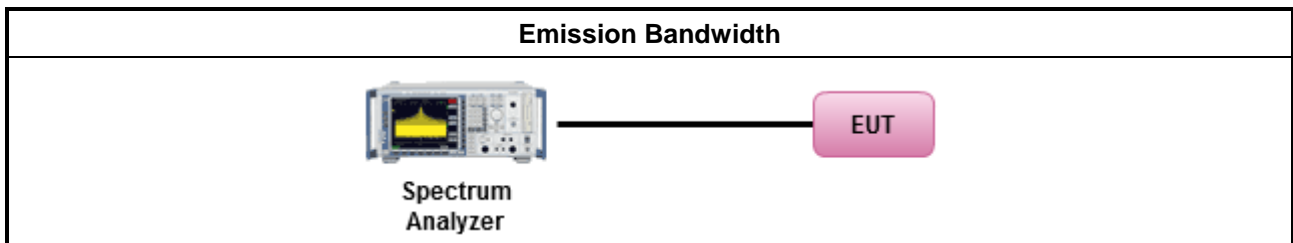
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method
<ul style="list-style-type: none"> ▪ For the emission bandwidth shall be measured using one of the options below:
<input checked="" type="checkbox"/> Refer as KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as RSS-Gen, clause 6.7 for for occupied bandwidth testing.
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.3 for occupied bandwidth testing.

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B

3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
	<ul style="list-style-type: none"> ▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	<ul style="list-style-type: none"> ▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	<ul style="list-style-type: none"> ▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	<ul style="list-style-type: none"> ▪ Smart antenna system (SAS):
	<ul style="list-style-type: none"> - Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	<ul style="list-style-type: none"> - Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	<ul style="list-style-type: none"> - Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dB dBm
e.i.r.p. Power Limit:	
	<ul style="list-style-type: none"> ▪ 2400-2483.5 MHz Band
	<ul style="list-style-type: none"> ▪ Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
	<ul style="list-style-type: none"> ▪ Point-to-point systems (P2P): $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX}])$ dBm
	<ul style="list-style-type: none"> ▪ Smart antenna system (SAS)
	<ul style="list-style-type: none"> - Single beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	<ul style="list-style-type: none"> - Overlap beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	<ul style="list-style-type: none"> - Aggregate power on all beams: $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX} + 8])$ dBm
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.	

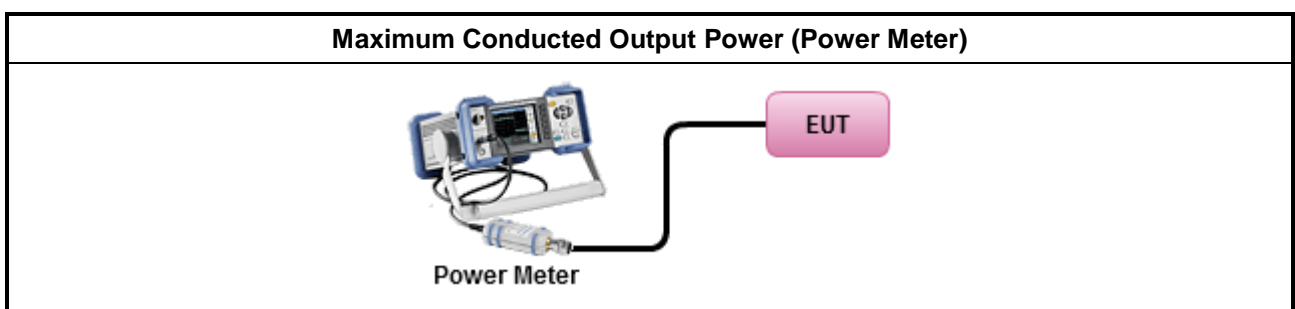
3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method	
<ul style="list-style-type: none"> ▪ Maximum Peak Conducted Output Power 	
<input type="checkbox"/>	Refer as KDB 558074, clause 9.1.1 Option 1 (RBW ≥ EBW method).
<input type="checkbox"/>	Refer as KDB 558074, clause 9.1.2 Option 2 (integrated band power method)
<input type="checkbox"/>	Refer as KDB 558074, clause 9.1.3 Option 3 (peak power meter for VBW ≥ DTS BW)
<ul style="list-style-type: none"> ▪ Maximum Average Conducted Output Power 	
Duty cycle ≥ 98%	
<input type="checkbox"/>	Refer as KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging).
Duty cycle < 98%	
<input type="checkbox"/>	Refer as KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed)
RF power meter and average over on/off periods with duty factor or gated trigger	
<input checked="" type="checkbox"/>	Refer as KDB 558074, clause 9.2.3.1 Method AVGPM (using an RF average power meter).
<ul style="list-style-type: none"> ▪ For conducted measurement. 	
<ul style="list-style-type: none"> ▪ If the EUT supports multiple transmit chains using options given below: Refer as KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them. 	
<ul style="list-style-type: none"> ▪ If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$ 	

3.3.4 Test Setup



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
<ul style="list-style-type: none"> Power Spectral Density (PSD) ≤ 8 dBm/3kHz

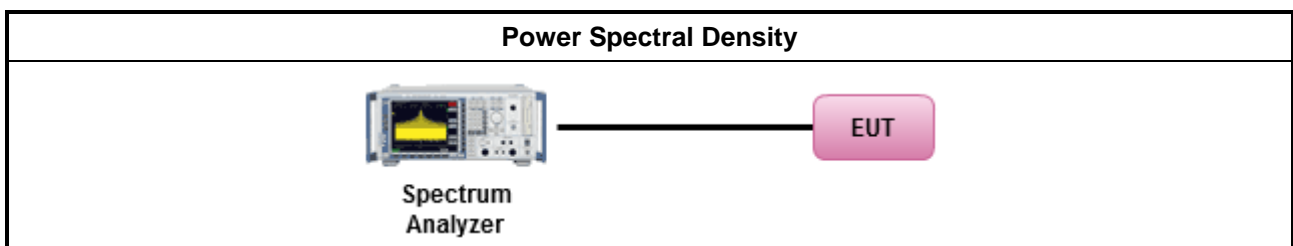
3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method
<ul style="list-style-type: none"> Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).
<input checked="" type="checkbox"/> Refer as KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz; Detector=peak).
<ul style="list-style-type: none"> For conducted measurement. <ul style="list-style-type: none"> If The EUT supports multiple transmit chains using options given below: <ul style="list-style-type: none"> Measure and sum the spectra across the outputs. Refer as KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.

3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Band Emissions Limit	
RF output power procedure	Limit (dB)
Peak output power procedure	20
Average output power procedure	30

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

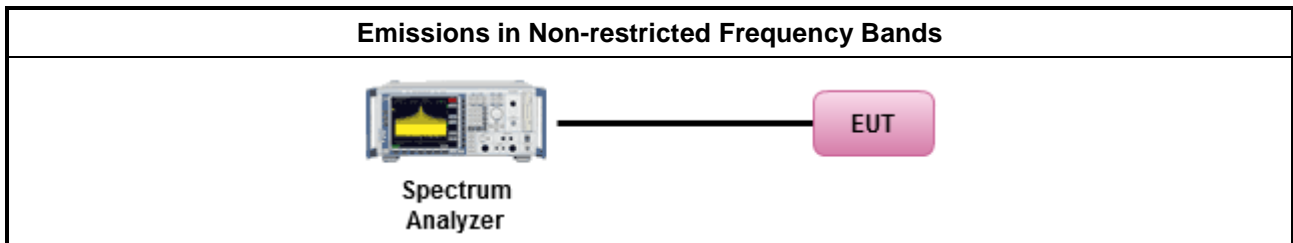
3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method
<ul style="list-style-type: none"> Refer as KDB 558074, clause 11 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

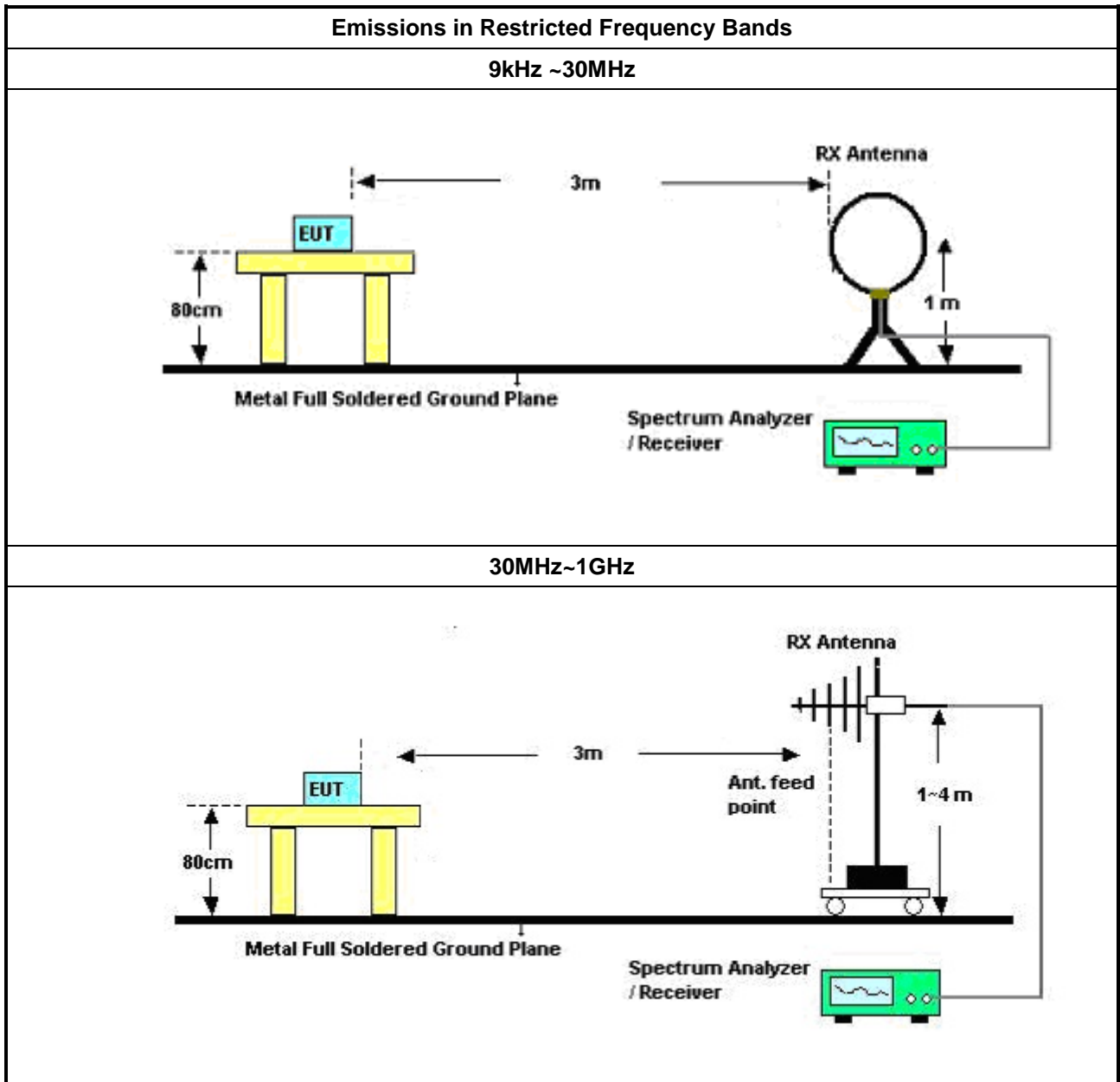
3.6.2 Measuring Instruments

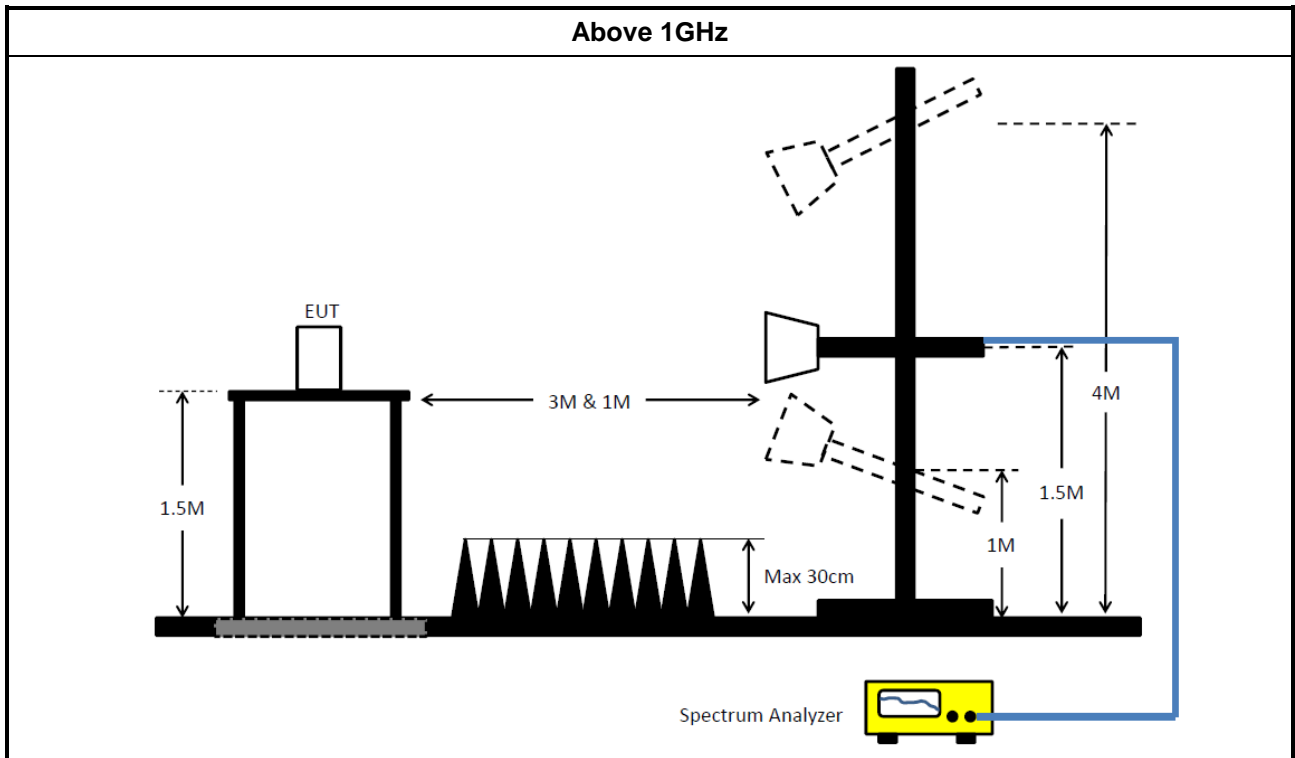
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

Test Method	
<ul style="list-style-type: none"> ▪ The average emission levels shall be measured in [duty cycle \geq 98 or duty factor]. 	
<ul style="list-style-type: none"> ▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band. 	
<ul style="list-style-type: none"> ▪ For the transmitter unwanted emissions shall be measured using following options below: 	
<ul style="list-style-type: none"> ▪ Refer as KDB 558074, clause 12 for unwanted emissions into restricted bands. 	
	<input checked="" type="checkbox"/> Refer as KDB 558074, clause 12.2.5.3 (ANSI C63.10, clause 4.1.4.2.3), Reduced VBW \geq 1/T.
	<input checked="" type="checkbox"/> Refer as KDB 558074, clause 12.2.4 measurement procedure peak limit.
<ul style="list-style-type: none"> ▪ For the transmitter band-edge emissions shall be measured using following options below: 	
<ul style="list-style-type: none"> ▪ Refer as KDB 558074 clause 13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below. 	
<ul style="list-style-type: none"> ▪ Refer as KDB 558074, clause 13.2 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements. 	
<ul style="list-style-type: none"> ▪ Refer as KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz). 	
<ul style="list-style-type: none"> ▪ For conducted and cabinet radiation measurement, refer as KDB 558074, clause 12.2.2. 	
<ul style="list-style-type: none"> ▪ For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB 	
<ul style="list-style-type: none"> ▪ For KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred. 	

3.6.4 Test Setup





3.6.5 Test Result of Emissions in Restricted Frequency Bands (Below 30MHz)

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

3.6.6 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix F

4 Test Equipment and Calibration Data

Instrument for AC Conduction

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
EMC Receiver	R&S	ESR	102051	9KHz ~ 3.6GHz	03/May/2018	02/May/2019
LISN	R&S	ENV216	101295	9kHz ~ 30MHz	17/Nov/2017	16/Nov/2018
RF Cable-CON	HUBER+SUHNER	RG213/U	0761183202000 1	9kHz ~ 30MHz	06/Oct/2017	05/Oct/2018
AC POWER	APC	AFC-11005G	F310050055	47Hz~63Hz 5~300V	NCR	NCR
Impuls Begrenzer Puls e Limiter	SCHWARZBECK	VTSD 9561-F	9561-F041	9 kHz ~ 30 MHz	12/Oct/2017	11/Oct/2018

NCR : Non-Calibration Require

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz ~ 1GHz 3m	20/Oct/2017	19/Oct/2018
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	1GHz ~ 18GHz 3m	27/Oct/2017	26/Oct/2018
Amplifier	Agilent	8447D	2944A11149	100kHz ~ 1.3GHz	27Jul/2018	02/Jul/2019
Microwave Preamplifier	Agilent	8449B	3008A02373	1GHz ~ 26.5GHz	28/Sep/2017	27/Sep/2018
Spectrum Analyzer	Rohde & Schwarz	FSP40	100593	9KHz - 40GHz	12/Dec/2017	11/Dec/2018
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100354	9kHz ~ 2.75GHz	08/Dec/2017	07/Dec/2018
RF Cable-R03m	Jye Bao	RG142	CB017	9kHz ~ 1GHz	19/Jan/2018	18/Jan/2019
RF Cable-high	SUHNER	SUCOFLEX104	MY34918/4	1GHz ~ 40GHz	19/Jan/2018	18/Jan/2019
Bilog Antenna	SCHAFFNER	CBL 6112B	2723	30MHz ~ 1GHz	09/Sep/2017	08/Sep/2018
Double Ridged Guide Horn Antenna	SCHWARZBEC K	BBHA 9120D	BBHA 9120 D 1531	1GHz ~ 18GHz	18/Apr/ 2018	17/Apr/2019
Loop Antenna	TESEQ	HLA 6120	31244	9k-30MHz	29/Mar/2018	28/Mar/2019

NCR : Non-Calibration Require

**Instrument for Conducted Test**

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV 40	101500	10KHz ~ 40GHz	05/Feb/2018	04/Feb/2019
Power Sensor	Anritsu	MA2411B	0917017	300MHz ~ 40GHz	05/Feb/2018	04/Feb/2019
Power Meter	Anritsu	ML2495A	0949003	300MHz ~ 40GHz	05/Feb/2018	04/Feb/2019
RF Cable-0.2m	HUBER+SUHNER	SUCOFLEX_104	MY10710/4	30MHz ~ 26.5GHz	17/Jan/2018	16/Jan/2019
RF Cable-0.2m	HUBER+SUHNER	SUCOFLEX_104	MY10709/4	30MHz ~ 26.5GHz	17/Jan/2018	16/Jan/2019
RF Cable-0.5m	HUBER+SUHNER	SUCOFLEX_104	MY10713/4	30MHz ~ 26.5GHz	17/Jan/2018	16/Jan/2019
Signal Generator	R&S	SMB100A	175727	100kHz~40GHz	26/Oct/2017	25/Oct/2018



AC Power-line Conducted Emissions Result																																																																																																																																										
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Summary

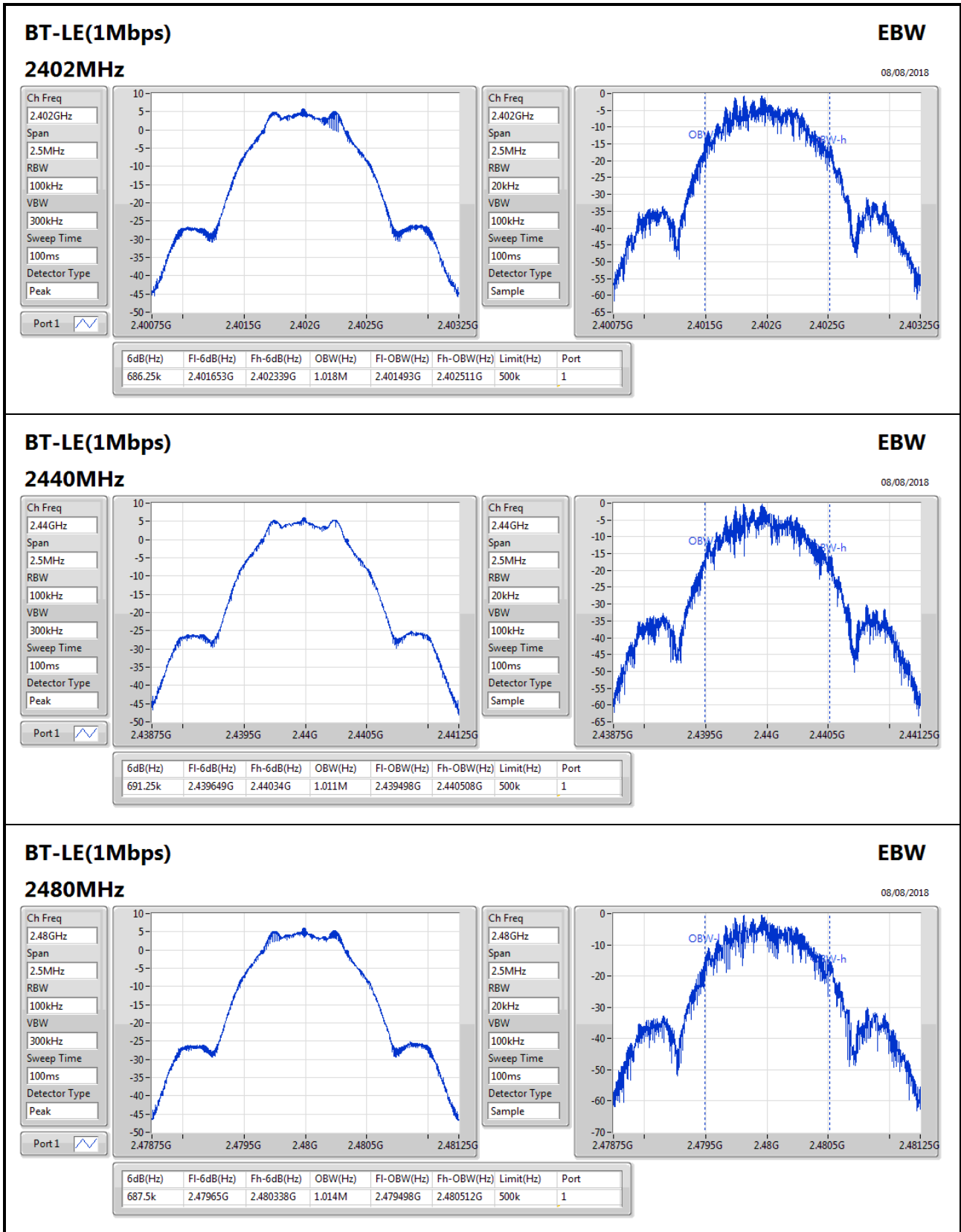
Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-LE(1Mbps)	691.25k	1.018M	1M02F1D	686.25k	1.011M

Max-N dB = Maximum 6dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz_TnomVnom	Pass	500k	686.25k	1.018M
2440MHz_TnomVnom	Pass	500k	691.25k	1.011M
2480MHz_TnomVnom	Pass	500k	687.5k	1.014M

Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;





Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	5.60	0.00363

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz_TnomVnom	Pass	1.71	5.24	30.00
2440MHz_TnomVnom	Pass	1.71	5.60	30.00
2480MHz_TnomVnom	Pass	1.71	5.57	30.00



Summary

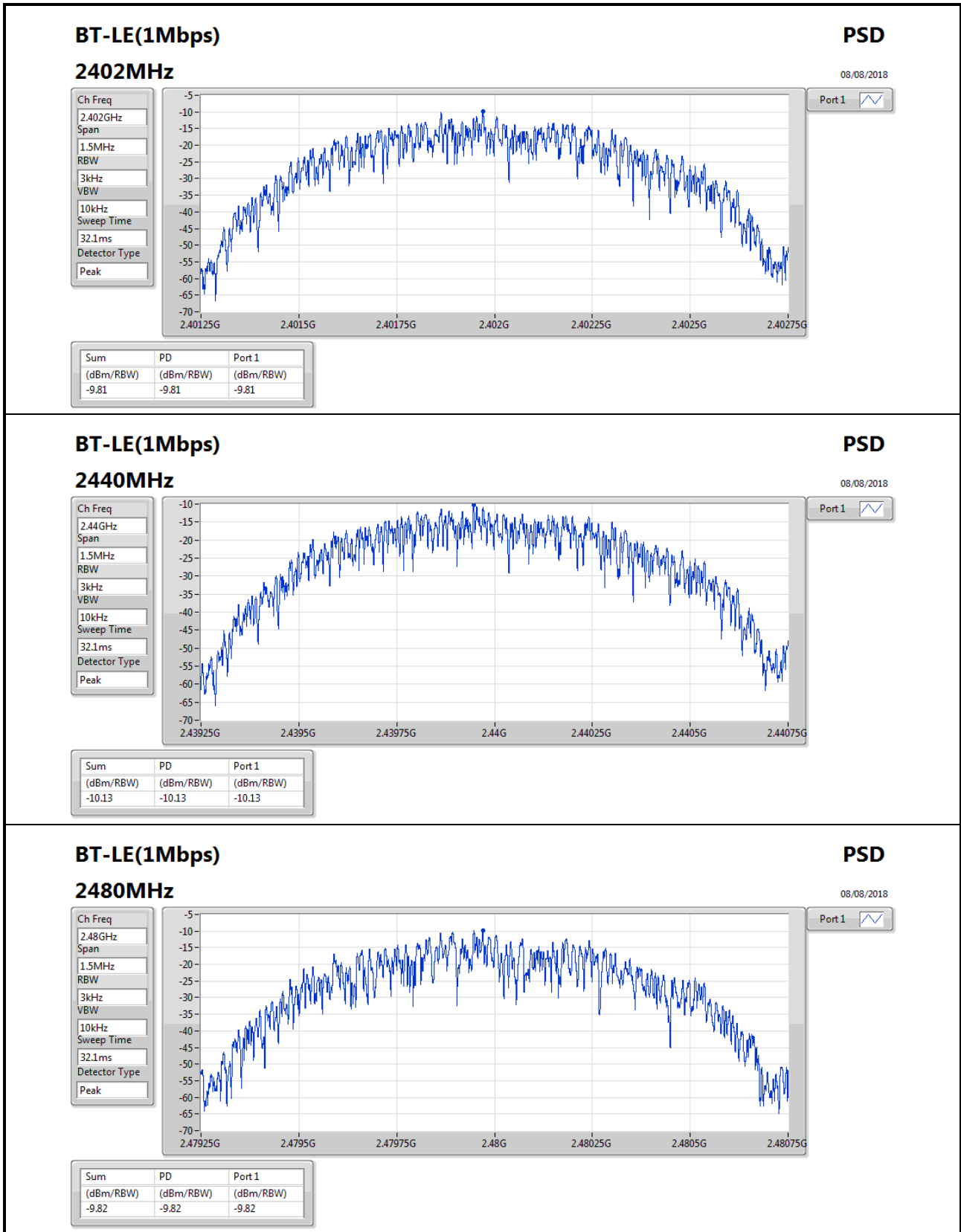
Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-9.81

RBW=3kHz.

Result

Mode	Result	Gain (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz_TnomVnom	Pass	1.71	-9.81	8.00
2440MHz_TnomVnom	Pass	1.71	-10.13	8.00
2480MHz_TnomVnom	Pass	1.71	-9.82	8.00

RBW=3kHz.



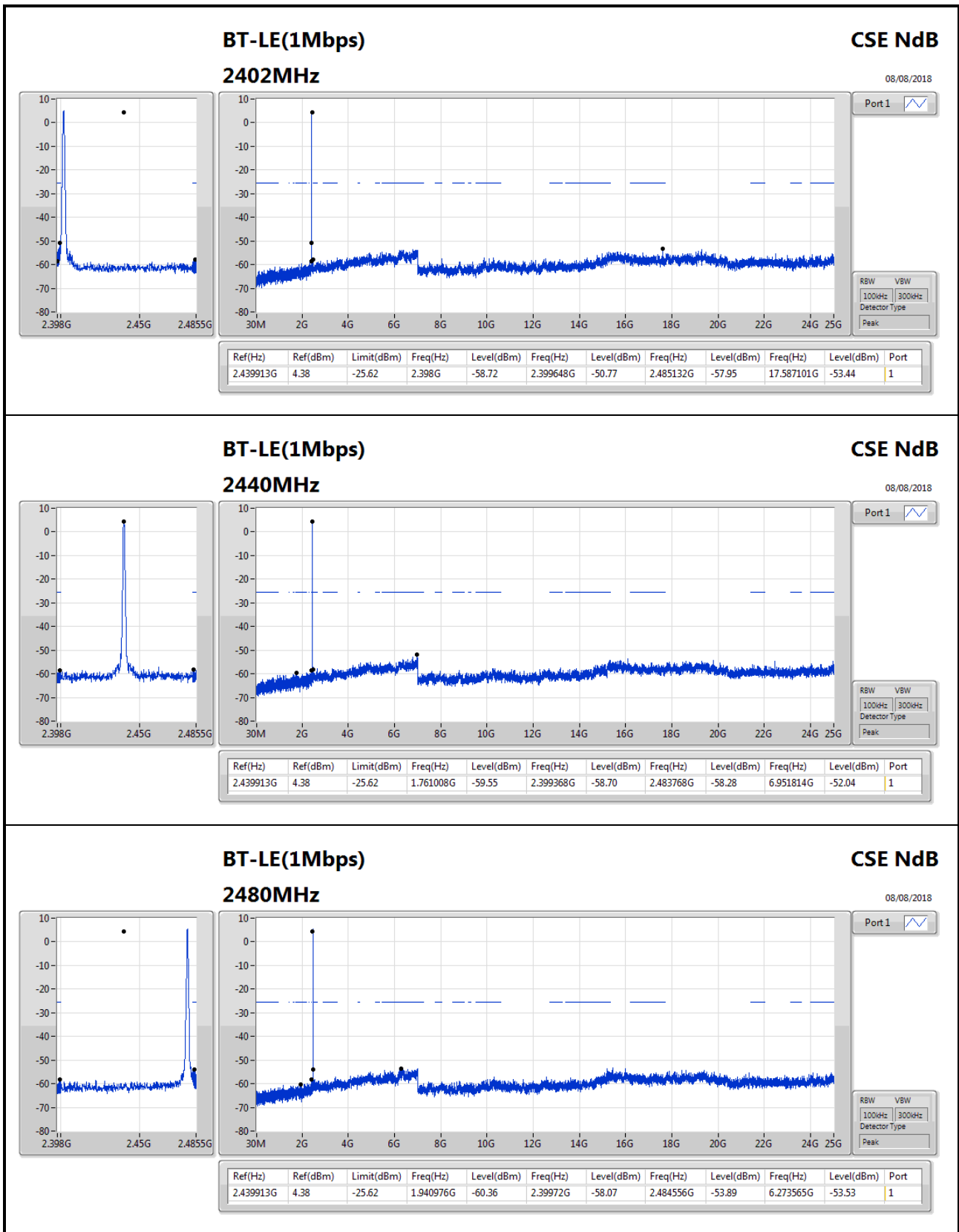


Summary

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	2.439913G	4.38	-25.62	2.398G	-58.72	2.399648G	-50.77	2.485132G	-57.95	17.587101G	-53.44	1

Result

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.439913G	4.38	-25.62	2.398G	-58.72	2.399648G	-50.77	2.485132G	-57.95	17.587101G	-53.44	1
2440MHz_TnomVnom	Pass	2.439913G	4.38	-25.62	1.761008G	-59.55	2.399368G	-58.70	2.483768G	-58.28	6.951814G	-52.04	1
2480MHz_TnomVnom	Pass	2.439913G	4.38	-25.62	1.940976G	-60.36	2.39972G	-58.07	2.484556G	-53.89	6.273565G	-53.53	1



BT-LE(1Mbps)

2480MHz

CSE NdB

08/08/2018

Port1

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.439913G	4.38	-25.62	1.940976G	-60.36	2.39972G	-58.07	2.484556G	-53.89	6.273565G	-53.53	1



Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	QP	78.5M	33.50	40.00	-6.50	-14.74	3	Vertical	360	2.00	-



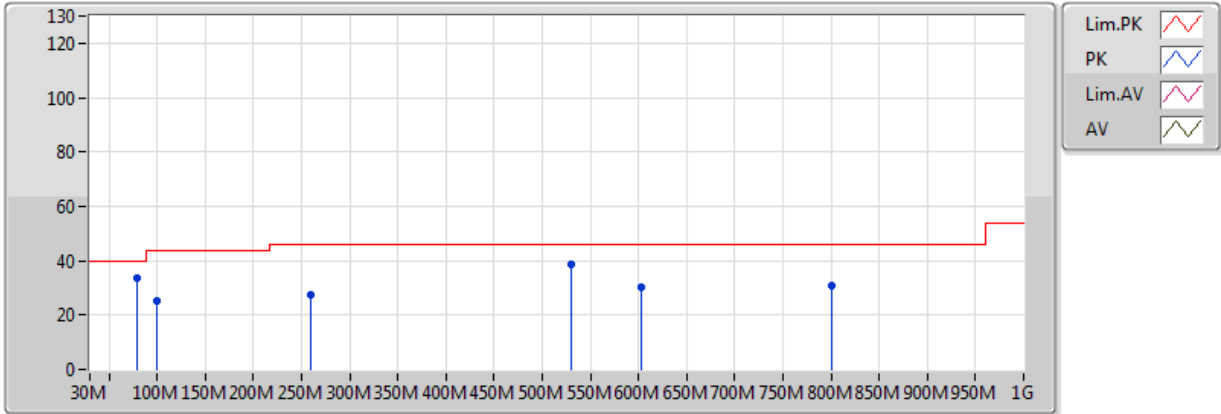
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2440MHz	Pass	PK	99.84M	25.28	43.50	-18.22	-10.34	3	Vertical	360	2.00	-
2440MHz	Pass	PK	258.92M	27.53	46.00	-18.47	-5.68	3	Vertical	360	2.00	-
2440MHz	Pass	PK	530.52M	38.86	46.00	-7.14	-1.91	3	Vertical	360	2.00	-
2440MHz	Pass	PK	602.3M	30.40	46.00	-15.60	-0.86	3	Vertical	360	2.00	-
2440MHz	Pass	PK	800.18M	31.03	46.00	-14.97	1.34	3	Vertical	360	2.00	-
2440MHz	Pass	QP	78.5M	33.50	40.00	-6.50	-14.74	3	Vertical	360	2.00	-
2440MHz	Pass	PK	191.02M	25.10	43.50	-18.40	-10.89	3	Horizontal	0	2.00	-
2440MHz	Pass	PK	243.4M	26.74	46.00	-19.26	-7.66	3	Horizontal	0	2.00	-
2440MHz	Pass	PK	474.26M	35.80	46.00	-10.20	-2.28	3	Horizontal	0	2.00	-
2440MHz	Pass	PK	730.34M	29.20	46.00	-16.80	0.69	3	Horizontal	0	2.00	-
2440MHz	Pass	PK	831.22M	29.68	46.00	-16.32	1.82	3	Horizontal	0	2.00	-
2440MHz	Pass	QP	78.5M	31.49	40.00	-8.51	-14.74	3	Horizontal	0	2.00	-

BT-LE(1Mbps)

2440MHz_TX

09/08/2018

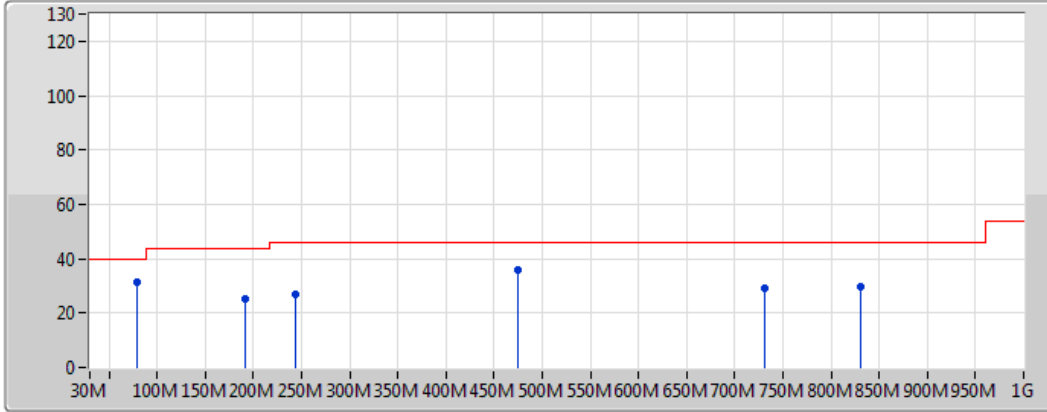


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	99.84M	25.28	43.50	-18.22	-10.34	3	Vertical	360	2.00	-
PK	258.92M	27.53	46.00	-18.47	-5.68	3	Vertical	360	2.00	-
PK	530.52M	38.86	46.00	-7.14	-1.91	3	Vertical	360	2.00	-
PK	602.3M	30.40	46.00	-15.60	-0.86	3	Vertical	360	2.00	-
PK	800.18M	31.03	46.00	-14.97	1.34	3	Vertical	360	2.00	-
QP	78.5M	33.50	40.00	-6.50	-14.74	3	Vertical	360	2.00	-

BT-LE(1Mbps)

2440MHz_TX

09/08/2018



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	191.02M	25.10	43.50	-18.40	-10.89	3	Horizontal	0	2.00	-
PK	243.4M	26.74	46.00	-19.26	-7.66	3	Horizontal	0	2.00	-
PK	474.26M	35.80	46.00	-10.20	-2.28	3	Horizontal	0	2.00	-
PK	730.34M	29.20	46.00	-16.80	0.69	3	Horizontal	0	2.00	-
PK	831.22M	29.68	46.00	-16.32	1.82	3	Horizontal	0	2.00	-
QP	78.5M	31.49	40.00	-8.51	-14.74	3	Horizontal	0	2.00	-



Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	AV	2.483502G	46.16	54.00	-7.84	32.61	3	Horizontal	334	1.50	-



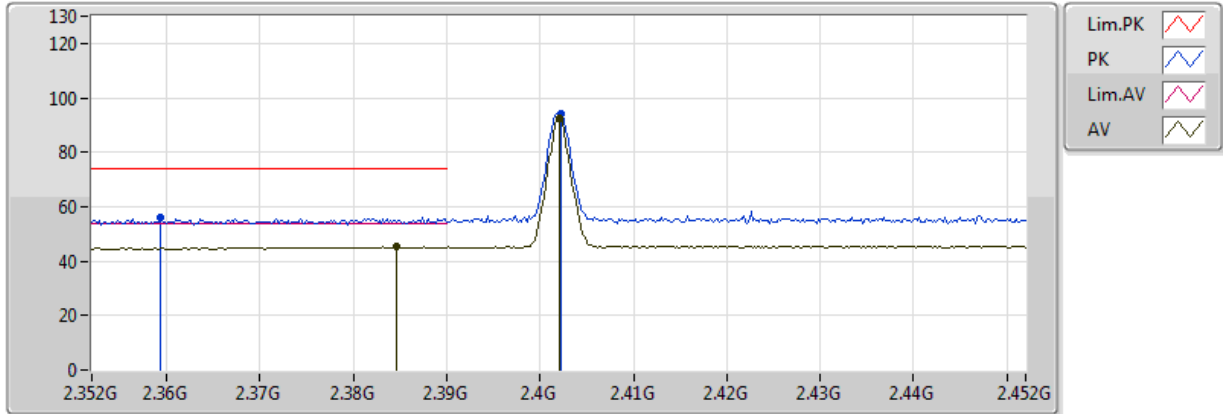
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	AV	2.3846G	45.24	54.00	-8.76	32.25	3	Vertical	14	2.85	-
2402MHz	Pass	AV	2.402G	92.53	Inf	-Inf	32.31	3	Vertical	14	2.85	-
2402MHz	Pass	PK	2.3594G	56.00	74.00	-18.00	32.16	3	Vertical	14	2.85	-
2402MHz	Pass	PK	2.4022G	93.95	Inf	-Inf	32.32	3	Vertical	14	2.85	-
2402MHz	Pass	AV	2.3874G	45.29	54.00	-8.71	32.26	3	Horizontal	342	1.93	-
2402MHz	Pass	AV	2.402G	96.56	Inf	-Inf	32.31	3	Horizontal	342	1.93	-
2402MHz	Pass	PK	2.3812G	56.14	74.00	-17.86	32.24	3	Horizontal	342	1.93	-
2402MHz	Pass	PK	2.4022G	98.00	Inf	-Inf	32.32	3	Horizontal	342	1.93	-
2402MHz	Pass	AV	4.804G	35.56	54.00	-18.44	2.99	3	Vertical	319	2.80	-
2402MHz	Pass	PK	4.80378G	46.80	74.00	-27.20	2.99	3	Vertical	319	2.80	-
2402MHz	Pass	AV	4.80359G	34.46	54.00	-19.54	2.99	3	Horizontal	33	2.77	-
2402MHz	Pass	PK	4.80361G	45.94	74.00	-28.06	2.99	3	Horizontal	33	2.77	-
2440MHz	Pass	AV	2.3872G	44.50	54.00	-9.50	32.26	3	Vertical	345	2.51	-
2440MHz	Pass	AV	2.44G	77.66	Inf	-Inf	32.46	3	Vertical	345	2.51	-
2440MHz	Pass	AV	2.498G	45.22	54.00	-8.78	32.67	3	Vertical	345	2.51	-
2440MHz	Pass	PK	2.358G	56.37	74.00	-17.63	32.16	3	Vertical	345	2.51	-
2440MHz	Pass	PK	2.4396G	91.68	Inf	-Inf	32.46	3	Vertical	345	2.51	-
2440MHz	Pass	PK	2.494G	57.37	74.00	-16.63	32.65	3	Vertical	345	2.51	-
2440MHz	Pass	AV	2.386G	44.47	54.00	-9.53	32.26	3	Horizontal	339	1.96	-
2440MHz	Pass	AV	2.44G	82.54	Inf	-Inf	32.46	3	Horizontal	339	1.96	-
2440MHz	Pass	AV	2.4996G	45.22	54.00	-8.78	32.67	3	Horizontal	339	1.96	-
2440MHz	Pass	PK	2.3532G	56.09	74.00	-17.91	32.14	3	Horizontal	339	1.96	-
2440MHz	Pass	PK	2.4396G	98.57	Inf	-Inf	32.46	3	Horizontal	339	1.96	-
2440MHz	Pass	PK	2.4956G	56.68	74.00	-17.32	32.65	3	Horizontal	339	1.96	-
2440MHz	Pass	AV	4.87983G	34.55	54.00	-19.45	3.16	3	Vertical	318	2.73	-
2440MHz	Pass	PK	4.88067G	48.39	74.00	-25.61	3.17	3	Vertical	318	2.73	-
2440MHz	Pass	AV	4.87987G	33.16	54.00	-20.84	3.16	3	Horizontal	34	2.85	-
2440MHz	Pass	PK	4.87932G	46.35	74.00	-27.65	3.16	3	Horizontal	34	2.85	-
2480MHz	Pass	AV	2.48G	78.53	Inf	-Inf	32.60	3	Vertical	331	2.99	-
2480MHz	Pass	AV	2.483502G	45.27	54.00	-8.73	32.61	3	Vertical	331	2.99	-
2480MHz	Pass	PK	2.4798G	92.86	Inf	-Inf	32.60	3	Vertical	331	2.99	-
2480MHz	Pass	PK	2.485G	56.86	74.00	-17.14	32.61	3	Vertical	331	2.99	-
2480MHz	Pass	AV	2.48G	82.73	Inf	-Inf	32.60	3	Horizontal	334	1.50	-
2480MHz	Pass	AV	2.483502G	46.16	54.00	-7.84	32.61	3	Horizontal	334	1.50	-
2480MHz	Pass	PK	2.4798G	98.46	Inf	-Inf	32.60	3	Horizontal	334	1.50	-
2480MHz	Pass	PK	2.4914G	57.04	74.00	-16.96	32.64	3	Horizontal	334	1.50	-
2480MHz	Pass	AV	4.95986G	34.62	54.00	-19.38	3.33	3	Vertical	313	2.97	-
2480MHz	Pass	PK	4.95967G	47.61	74.00	-26.39	3.33	3	Vertical	313	2.97	-
2480MHz	Pass	AV	4.96005G	32.80	54.00	-21.20	3.33	3	Horizontal	43	2.94	-
2480MHz	Pass	PK	4.95942G	46.29	74.00	-27.71	3.33	3	Horizontal	43	2.94	-

BT-LE(1Mbps)

2402MHz_TX

07/08/2018

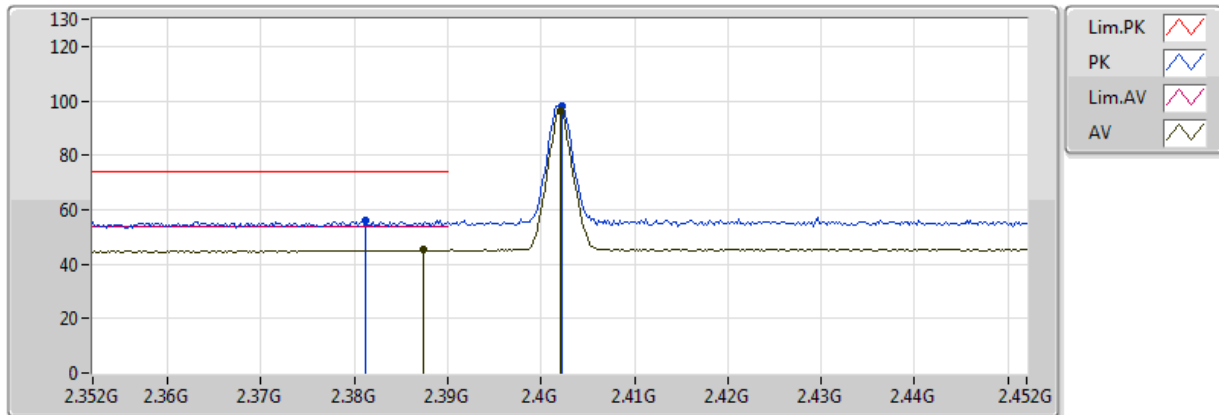


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	2.3846G	45.24	54.00	-8.76	32.25	3	Vertical	14	2.85	-
AV	2.402G	92.53	Inf	-Inf	32.31	3	Vertical	14	2.85	-
PK	2.3594G	56.00	74.00	-18.00	32.16	3	Vertical	14	2.85	-
PK	2.4022G	93.95	Inf	-Inf	32.32	3	Vertical	14	2.85	-

BT-LE(1Mbps)

2402MHz_TX

07/08/2018

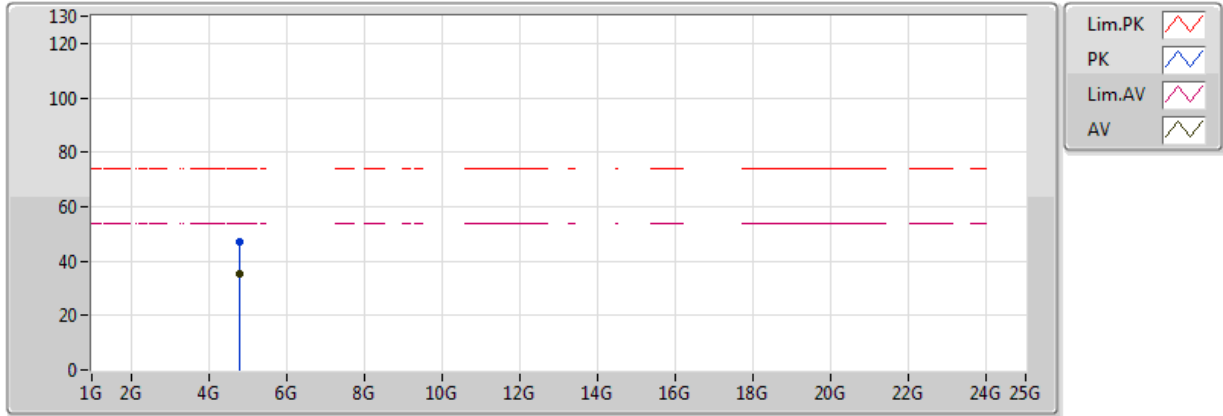


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	2.3874G	45.29	54.00	-8.71	32.26	3	Horizontal	342	1.93	-
AV	2.402G	96.56	Inf	-Inf	32.31	3	Horizontal	342	1.93	-
PK	2.3812G	56.14	74.00	-17.86	32.24	3	Horizontal	342	1.93	-
PK	2.4022G	98.00	Inf	-Inf	32.32	3	Horizontal	342	1.93	-

BT-LE(1Mbps)

2402MHz_TX

15/08/2018

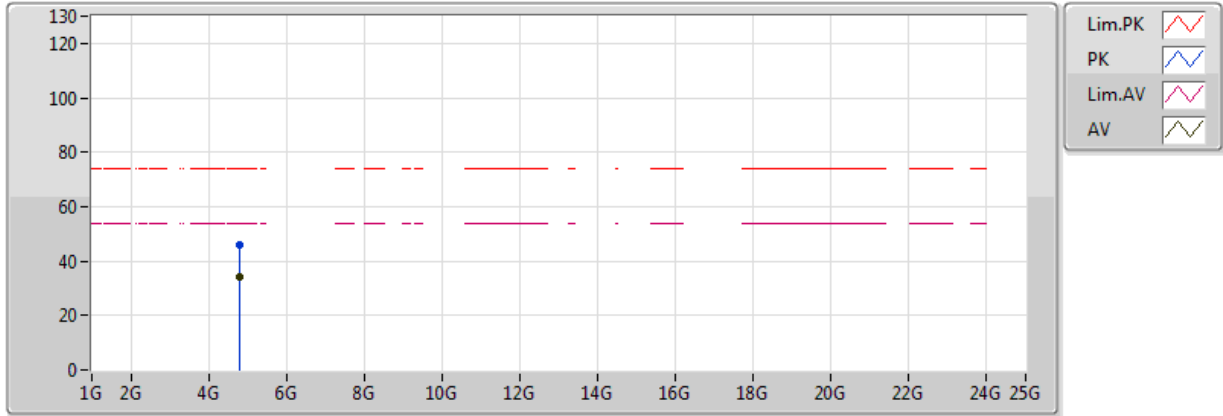


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	4.804G	35.56	54.00	-18.44	2.99	3	Vertical	319	2.80	-
PK	4.80378G	46.80	74.00	-27.20	2.99	3	Vertical	319	2.80	-

BT-LE(1Mbps)

2402MHz_TX

15/08/2018

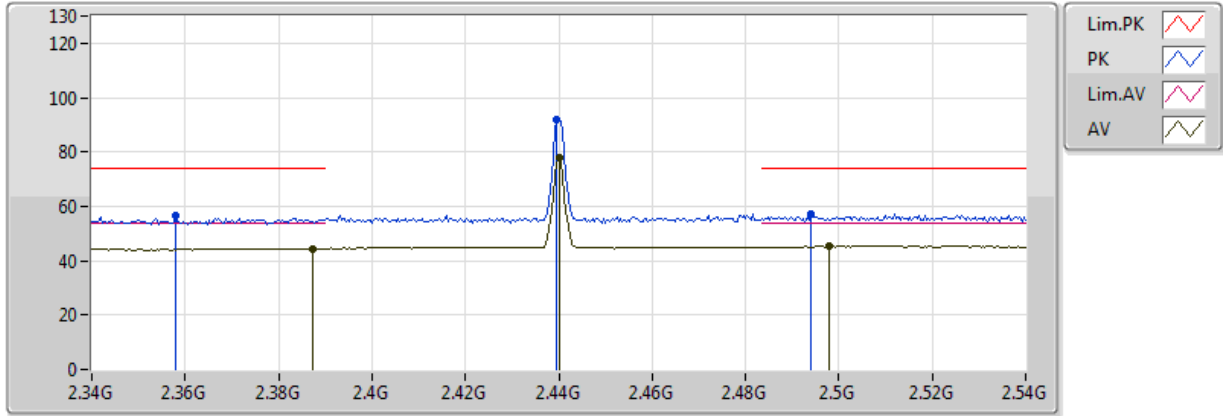


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	4.80359G	34.46	54.00	-19.54	2.99	3	Horizontal	33	2.77	-
PK	4.80361G	45.94	74.00	-28.06	2.99	3	Horizontal	33	2.77	-

BT-LE(1Mbps)

2440MHz_TX

15/08/2018

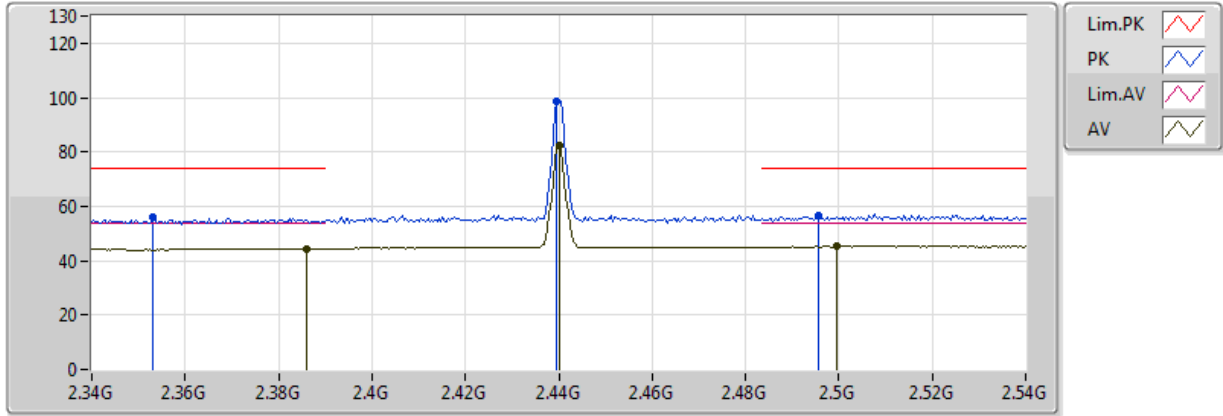


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	2.3872G	44.50	54.00	-9.50	32.26	3	Vertical	345	2.51	-
AV	2.44G	77.66	Inf	-Inf	32.46	3	Vertical	345	2.51	-
AV	2.498G	45.22	54.00	-8.78	32.67	3	Vertical	345	2.51	-
PK	2.358G	56.37	74.00	-17.63	32.16	3	Vertical	345	2.51	-
PK	2.4396G	91.68	Inf	-Inf	32.46	3	Vertical	345	2.51	-
PK	2.494G	57.37	74.00	-16.63	32.65	3	Vertical	345	2.51	-

BT-LE(1Mbps)

2440MHz_TX

15/08/2018

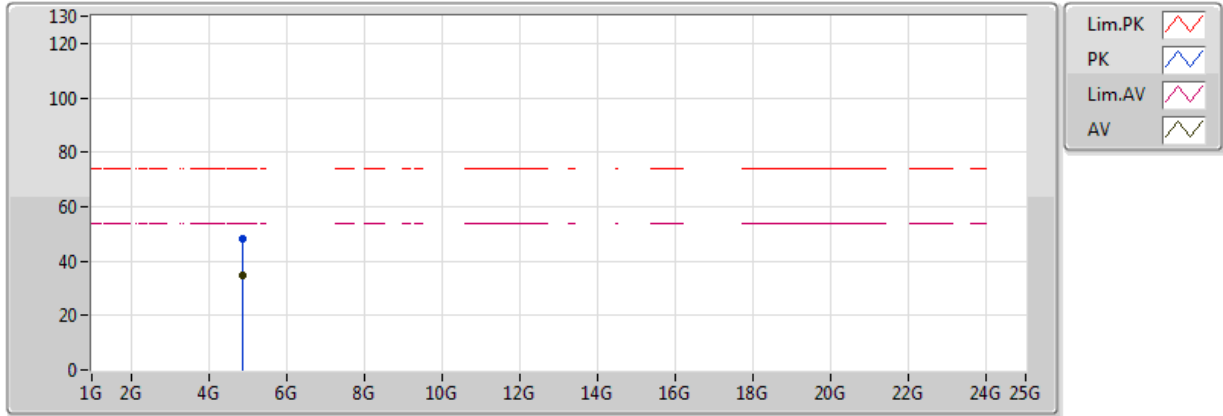


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	2.386G	44.47	54.00	-9.53	32.26	3	Horizontal	339	1.96	-
AV	2.44G	82.54	Inf	-Inf	32.46	3	Horizontal	339	1.96	-
AV	2.4996G	45.22	54.00	-8.78	32.67	3	Horizontal	339	1.96	-
PK	2.3532G	56.09	74.00	-17.91	32.14	3	Horizontal	339	1.96	-
PK	2.4396G	98.57	Inf	-Inf	32.46	3	Horizontal	339	1.96	-
PK	2.4956G	56.68	74.00	-17.32	32.65	3	Horizontal	339	1.96	-

BT-LE(1Mbps)

2440MHz_TX

15/08/2018

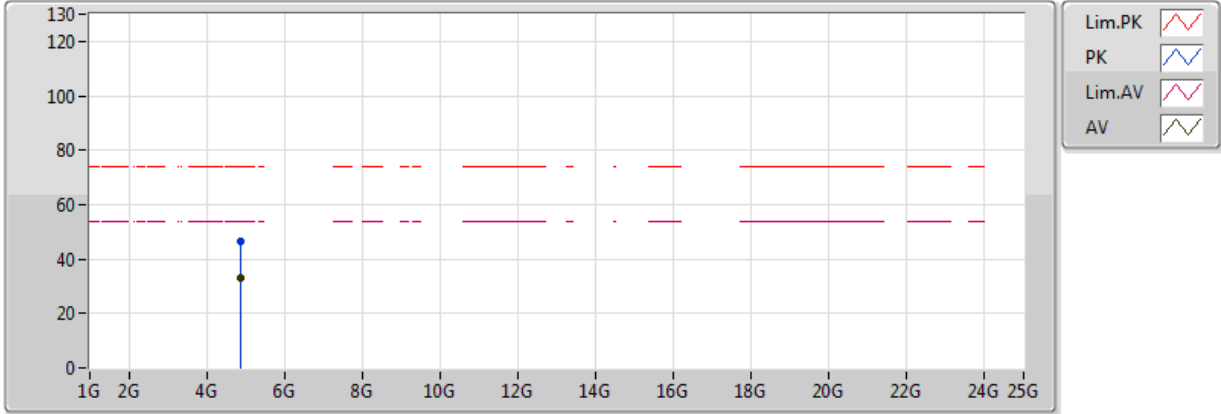


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	4.87983G	34.55	54.00	-19.45	3.16	3	Vertical	318	2.73	-
PK	4.88067G	48.39	74.00	-25.61	3.17	3	Vertical	318	2.73	-

BT-LE(1Mbps)

2440MHz_TX

15/08/2018

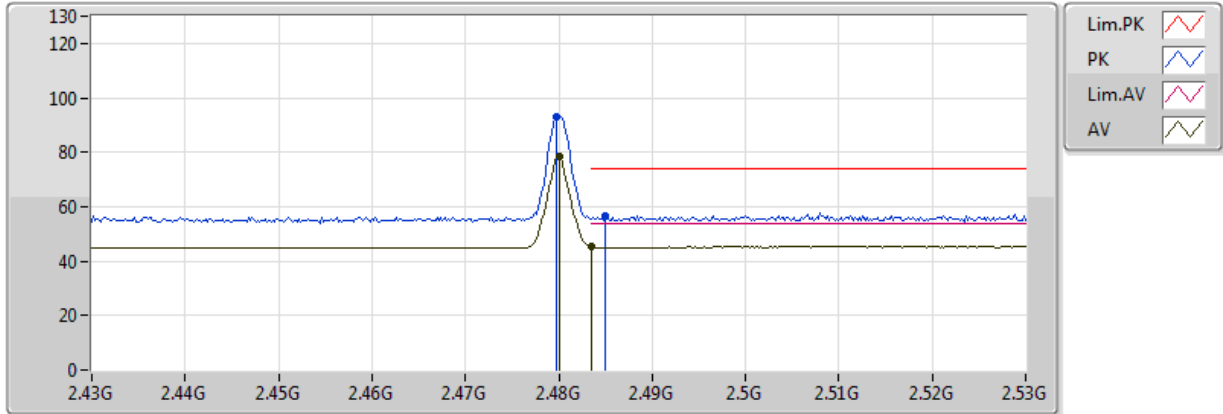


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	4.87987G	33.16	54.00	-20.84	3.16	3	Horizontal	34	2.85	-
PK	4.87932G	46.35	74.00	-27.65	3.16	3	Horizontal	34	2.85	-

BT-LE(1Mbps)

2480MHz_TX

15/08/2018

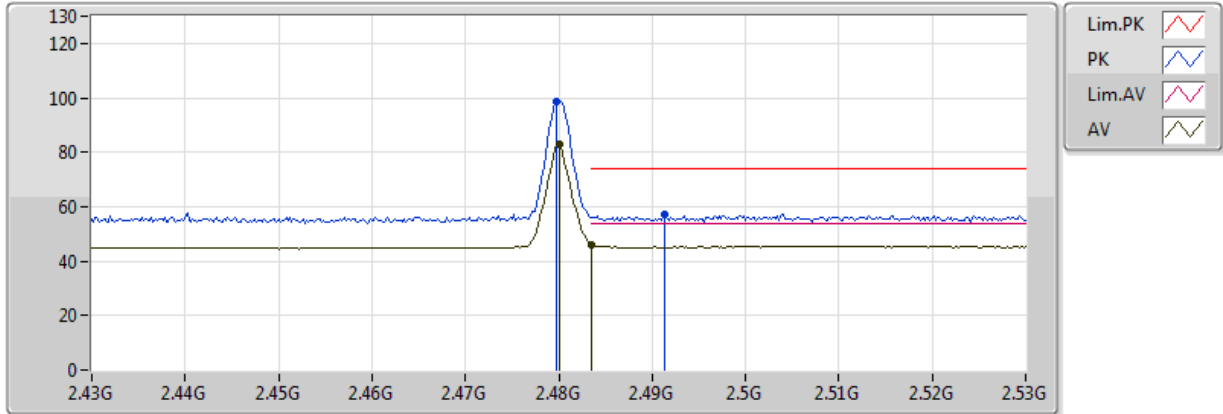


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	2.48G	78.53	Inf	-Inf	32.60	3	Vertical	331	2.99	-
AV	2.483502G	45.27	54.00	-8.73	32.61	3	Vertical	331	2.99	-
PK	2.4798G	92.86	Inf	-Inf	32.60	3	Vertical	331	2.99	-
PK	2.485G	56.86	74.00	-17.14	32.61	3	Vertical	331	2.99	-

BT-LE(1Mbps)

2480MHz_TX

15/08/2018

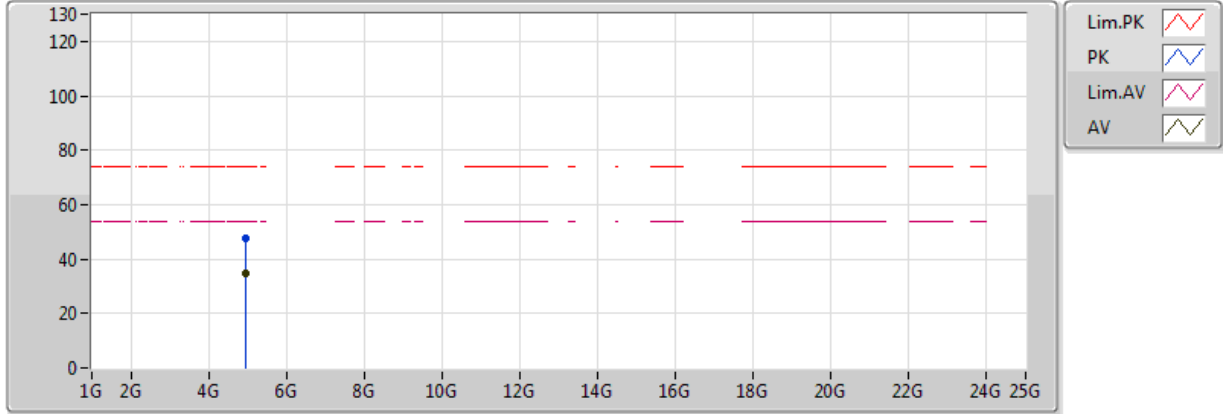


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	2.48G	82.73	Inf	-Inf	32.60	3	Horizontal	334	1.50	-
AV	2.483502G	46.16	54.00	-7.84	32.61	3	Horizontal	334	1.50	-
PK	2.4798G	98.46	Inf	-Inf	32.60	3	Horizontal	334	1.50	-
PK	2.4914G	57.04	74.00	-16.96	32.64	3	Horizontal	334	1.50	-

BT-LE(1Mbps)

2480MHz_TX

15/08/2018

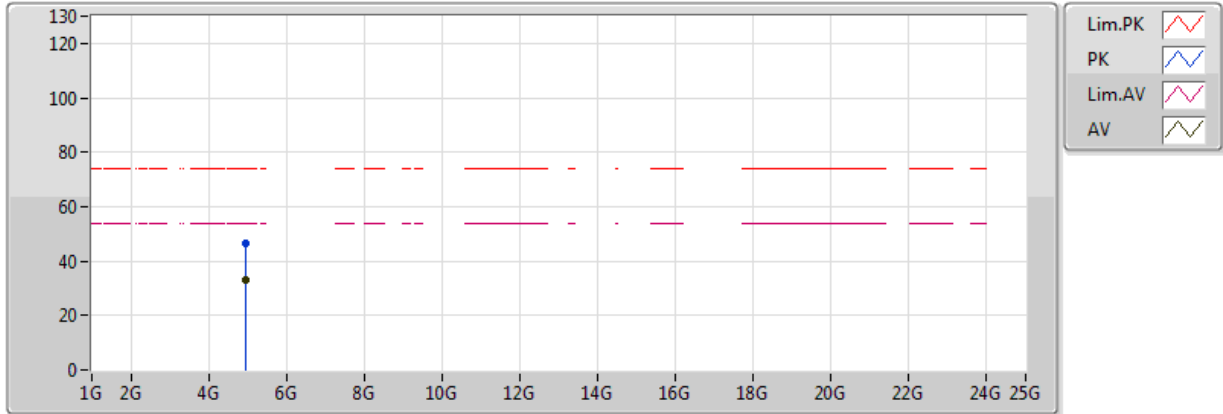


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	4.95986G	34.62	54.00	-19.38	3.33	3	Vertical	313	2.97	-
PK	4.95967G	47.61	74.00	-26.39	3.33	3	Vertical	313	2.97	-

BT-LE(1Mbps)

2480MHz_TX

15/08/2018



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
AV	4.96005G	32.80	54.00	-21.20	3.33	3	Horizontal	43	2.94	-
PK	4.95942G	46.29	74.00	-27.71	3.33	3	Horizontal	43	2.94	-