

FCC Test Report

FCC ID : 2ATD8-MN-01
Equipment : Mesh Node
Brand Name : Scandinavian Reach Technologies AS
Model Name : SRT MN-01
Applicant : Scandinavian Reach Technologies AS
Skjenet 11, 5354 Straume, Norway
Manufacturer : Topro Industri AS
Rambekkvegen 1, 2816 Gjøvik, Norway
Standard : 47 CFR FCC Part 15.247

The product was received on Sep. 10, 2019, and testing was started from Sep. 13, 2019 and completed on Oct. 14, 2019. . 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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History of this test report

[illegible]

Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.3	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

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

None.

Reviewed by: Jackson Tsai

Report Producer: Jenny Yang

General Description

1.1 Information

1.1.1 Abbreviation

EUT: Unit under test

BW: Bandwidth

BWch: Bandwidth per channel

1.1.2 RF General Information

Frequency Range (MHz)	Modulation	Channel Frequency (MHz)	Channel Spacing (MHz)	Channel Number
902-928	DSSS	902.8-927.4	0.2	3-126 [124]

Band	Mode	BWch (MHz)	Nant
902-928	DSSS	20	1

Note:

- ♦ 902-928 MHz Band uses a combination of DSSS modulation.
- ♦ BWch is the nominal channel bandwidth.
- ♦ Nant is the number of outputs.

1.1.3 Antenna Information

Antenna	Brand	Model Name	Antenna Type	Connector
1	Texas Instruments	DN007	PCB	N/A
2	Texas Instruments	DN007	PCB	N/A
3	Texas Instruments	DN038	PCB	N/A
4	pulselarsen	W5017	Dipole	I-Pex

Ant.	Port	Gain (dBi)		
		2.4G Prop	BT	Sub-1GHz
1	1	-	3.3	-
2	1	3.3	-	-
3	1	-	-	0.01
4	2	-	-	0.9

Note 1: The EUT has four antennas.

For 2.4GHz Prop function:

For 2.4GHz Prop mode (1TX/1RX)

Ant. 2 (port 1) can be used as transmitting/receiving antenna.

For BT function:

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

Ant. 1 (port 1) can be used as transmitting/receiving antenna.

For Sub-1GHz function:

For Sub-1GHz mode (1TX/1RX)

Ant. 3 (port 1) or Ant. 4 (port 2) can be used as transmitting/receiving antenna.

1.1.4 EUT Information

Operational Condition	
EUT Power Type	From AC Adapter / Form Battery / Form Host system
EUT Function	☒ Point-to-multipoint ☐ Point-to-point
Type of EUT	
☒	Stand-alone
☐	Combined (EUT where the radio part is fully integrated within another device)
	Combined Equipment - Brand Name / Model No.: ...
☐	Plug-in radio (EUT intended for a variety of host systems)
	Host System - Brand Name / Model No.: ...
☐	Other:

1.1.5 Mode Test Duty Cycle

Mode	Duty Cycle	Duty Cycle Factor (dB)	T(s)	VBW(Hz) $\geq 1/T$
DSSS	1	0	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)

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 v05

1.3 Testing Location Information

Testing Location			
☒	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.			
☐	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
AC Conduction	CO04-HY	Edward Wang	22.3~23.8°C / 64.3~66.2%	13/Sep/2019
RF Conducted	TH06-HY	Gary Wang	23.1~26°C / 61~67%	19/Sep/2019~01/Oct/2019
Radiated	03CH02-HY	Edward Wang	22.3~23.7°C / 65.3~69.2%	13/Sep/2019~14/Oct/2019

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)	3.54 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	1.6 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	3.7V

2.2 Test Channel Mode

Test Software	Command
---------------	---------

Mode	Power Setting
DSSS_Nss1_1TX	-
902.8MHz	Default
915MHz	Default
927.4MHz	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	Adapter mode

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density
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/CRX		
1	Adapter mode		
Operating Mode > 1GHz	CTX/CRX		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			
Worst Planes of EUT	V (External Antenna)	V (Internal Antenna)	

The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis
Operating Mode	CTX
1	Sub-1GHz + 2.4G Prop + Bluetooth
Refer to Sporton Test Report No.: FA990210 for Co-location RF Exposure Evaluation.	



2.4 Support Equipment

Support Equipment – AC Conduction				
No.	Equipment	Brand Name	Model Name	FCC ID
1	AC adapter	ARTESYN	DA10-050EU	-

Note: Support equipment No.1 was provided by customer.

Support Equipment – RF Conducted				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Laptop	HP	EliteBook 820	-
2	Adapter for Laptop	HP	HSTNN-DA40	-

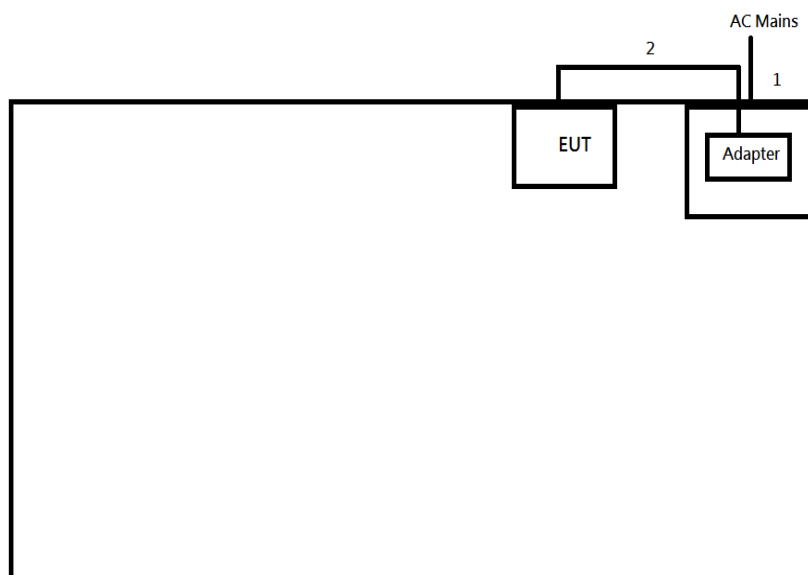
Note: Support equipment No.1 & 2 were provided by customer.

Support Equipment – Radiated Emission				
No.	Equipment	Brand Name	Model Name	FCC ID
1	AC adapter	ARTESYN	DA10-050EU	-

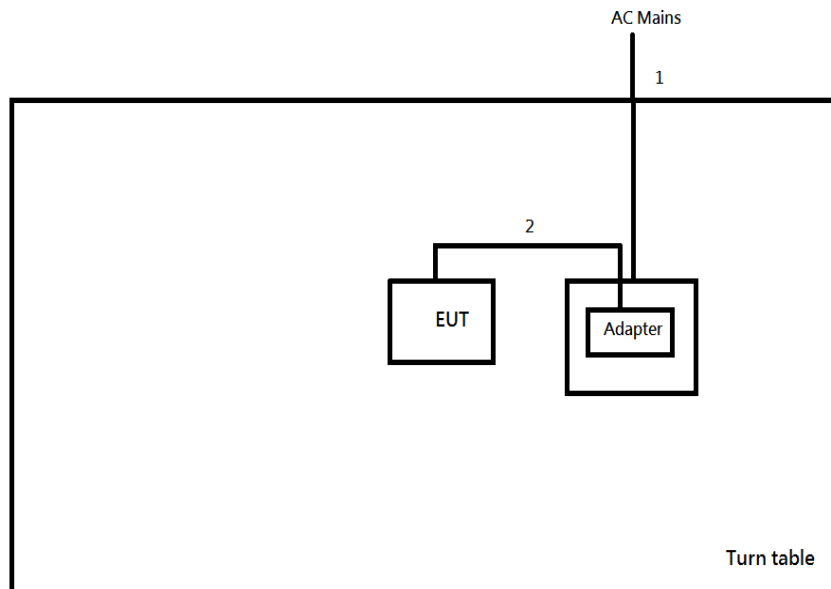
Note: Support equipment No.1 was provided by customer.

2.5 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power Cable	No	1.8	-
2	USB Cable	No	1.0	-

Test Setup Diagram - Radiated Test


Item	Connection	Shielded	Length(m)	Remark
1	AC Power Cable	No	1.8	-
2	USB Cable	No	1.0	-

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.

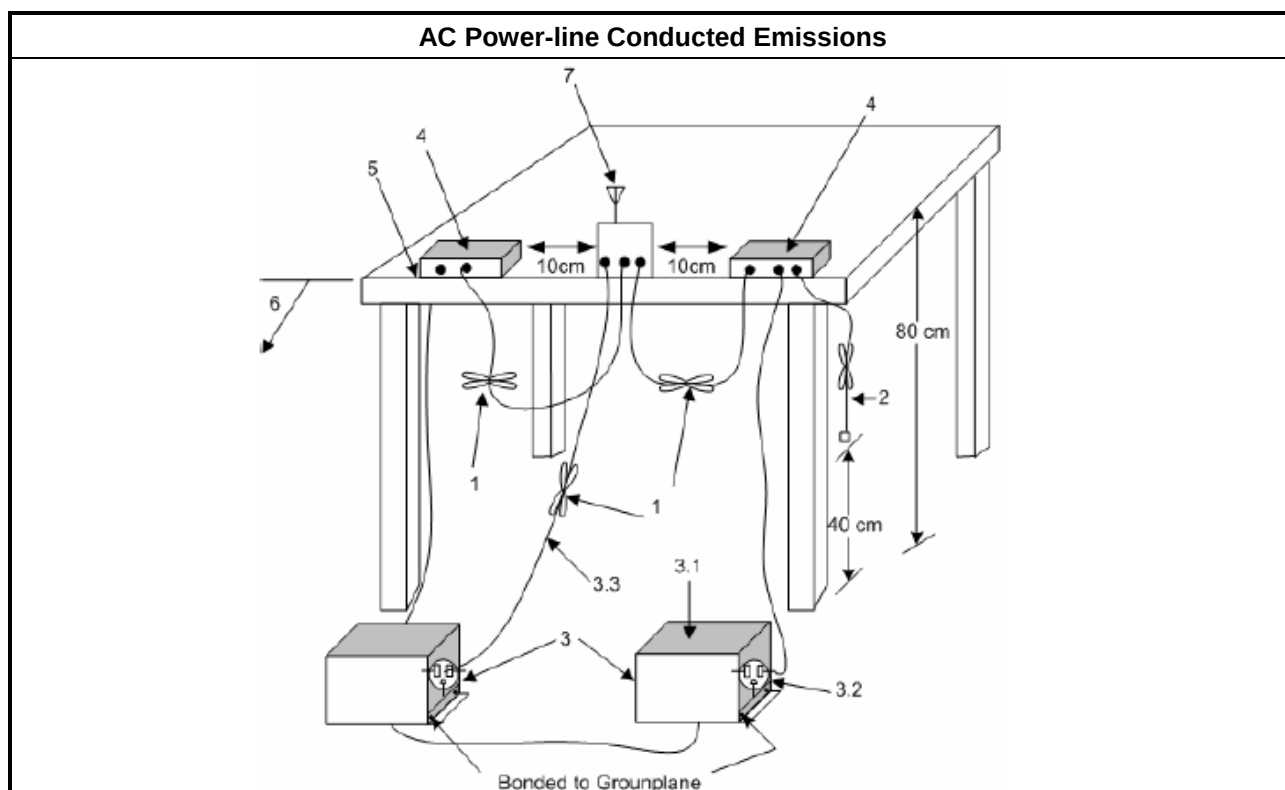
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2013, clause 6.2 for AC 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:	
▪	6 dB bandwidth $\geq$ 500 kHz.

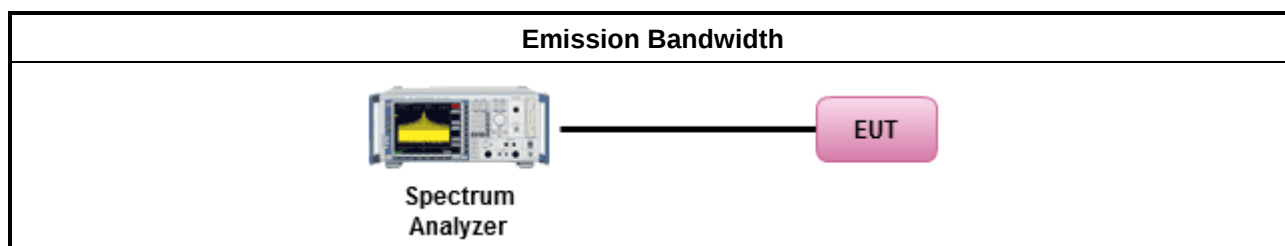
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
▪	For the emission bandwidth shall be measured using one of the options below:
☒	Refer as KDB 558074. clause 8.2 (11.9.2.2 of ANSI C63.10) DTS bandwidth measurement.
☐	Refer as RSS-Gen, clause 6.7 for occupied bandwidth testing.
☐	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		
	▪	If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	▪	Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	▪	Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	▪	Smart antenna system (SAS):
	-	Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	-	Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	-	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:		
	▪	2400-2483.5 MHz Band
	▪	Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
	▪	Point-to-point systems (P2P): $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX}])$ dBm
	▪	Smart antenna system (SAS)
	-	Single beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	-	Overlap beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	-	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.		

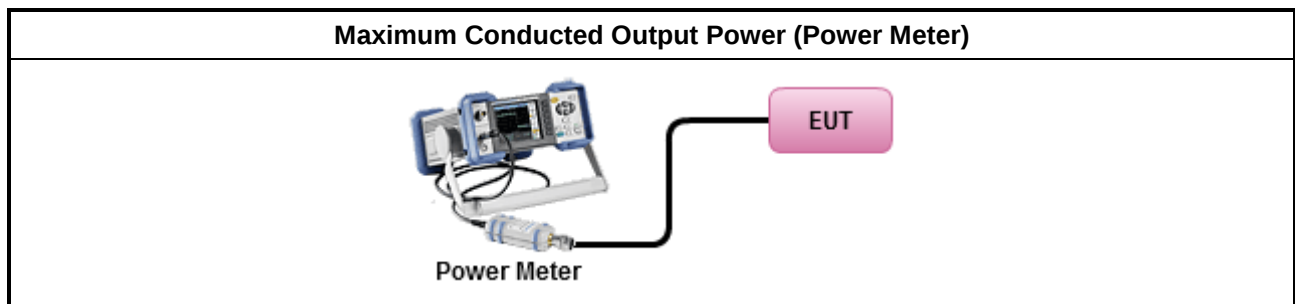
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
Maximum Peak Conducted Output Power	
☐	Refer as KDB 558074, clause 8.3.1.1 (11.9.1.1 of ANSI C63.10) RBW ≥ EBW method.
☐	Refer as KDB 558074, clause 8.3.1.2 (11.9.1.2 of ANSI C63.10) integrated band power method.
☐	Refer as KDB 558074, clause 8.3.1.3 (11.9.1.3 of ANSI C63.10) peak power meter.
Maximum Average Conducted Output Power	
☐	Refer as KDB 558074, clause 8.3.2.2 (11.9.2.2 of ANSI C63.10) using a spectrum analyzer.
☒	Refer as KDB 558074, clause 8.3.2.3 (11.9.2.3 of ANSI C63.10) using a power meter.
For conducted measurement.	
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.	
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	
▪	Power Spectral Density (PSD) $\leq$ 8 dBm/3kHz

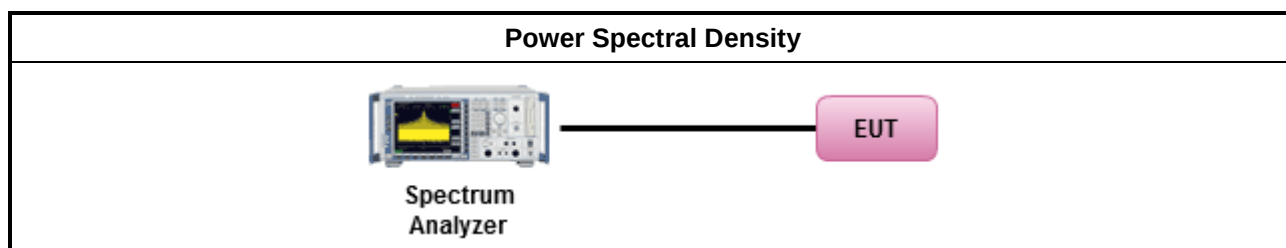
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method	
▪	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).
☒	Refer as KDB 558074, clause 8.4 (11.10 of ANSI C63.10) Method PKPSD.
▪	For conducted measurement.
▪	If The EUT supports multiple transmit chains using options given below:
▪	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.	

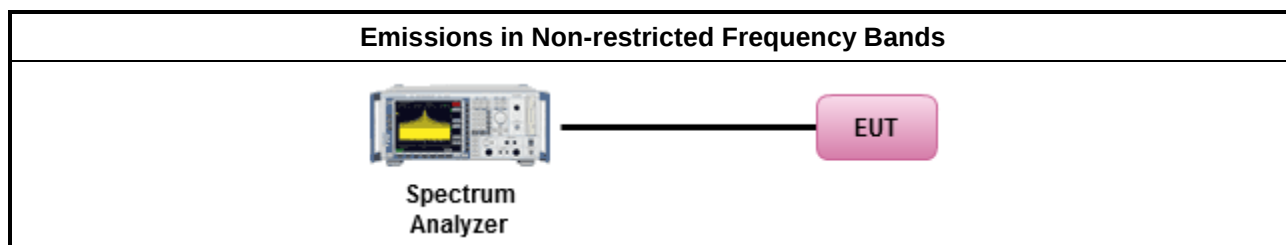
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method
Refer as KDB 558074, clause 8.5 (11.11 of ANSI C63.10) for non-restricted frequency 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.

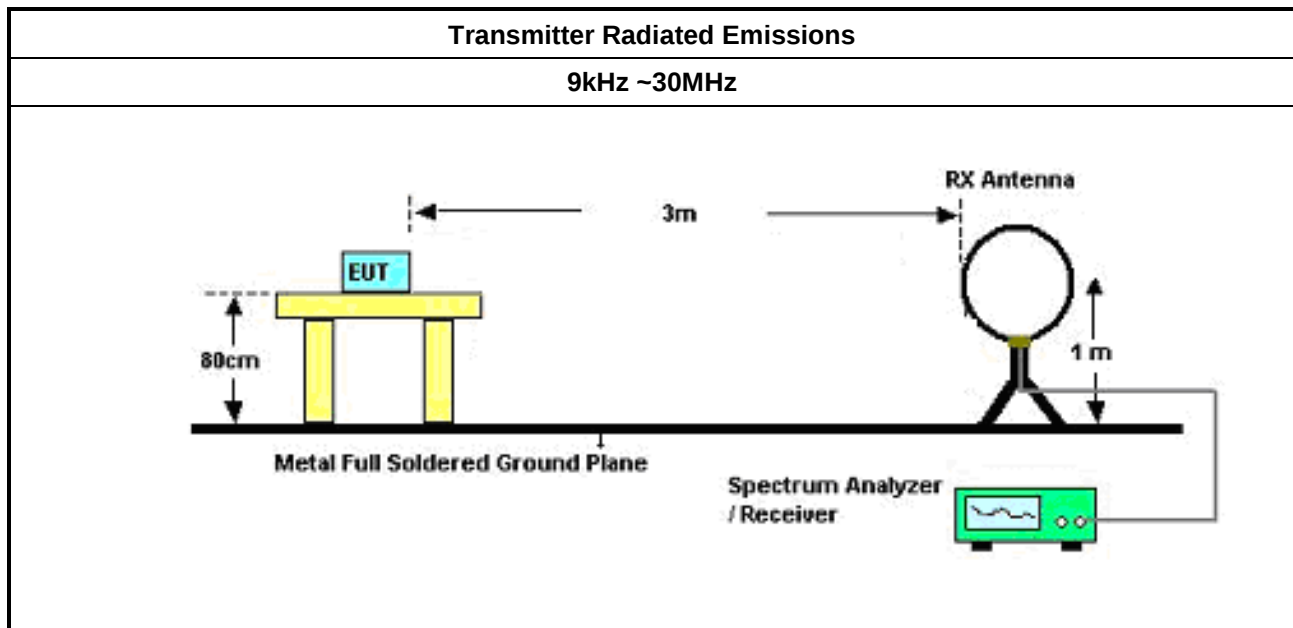
3.6.2 Measuring Instruments

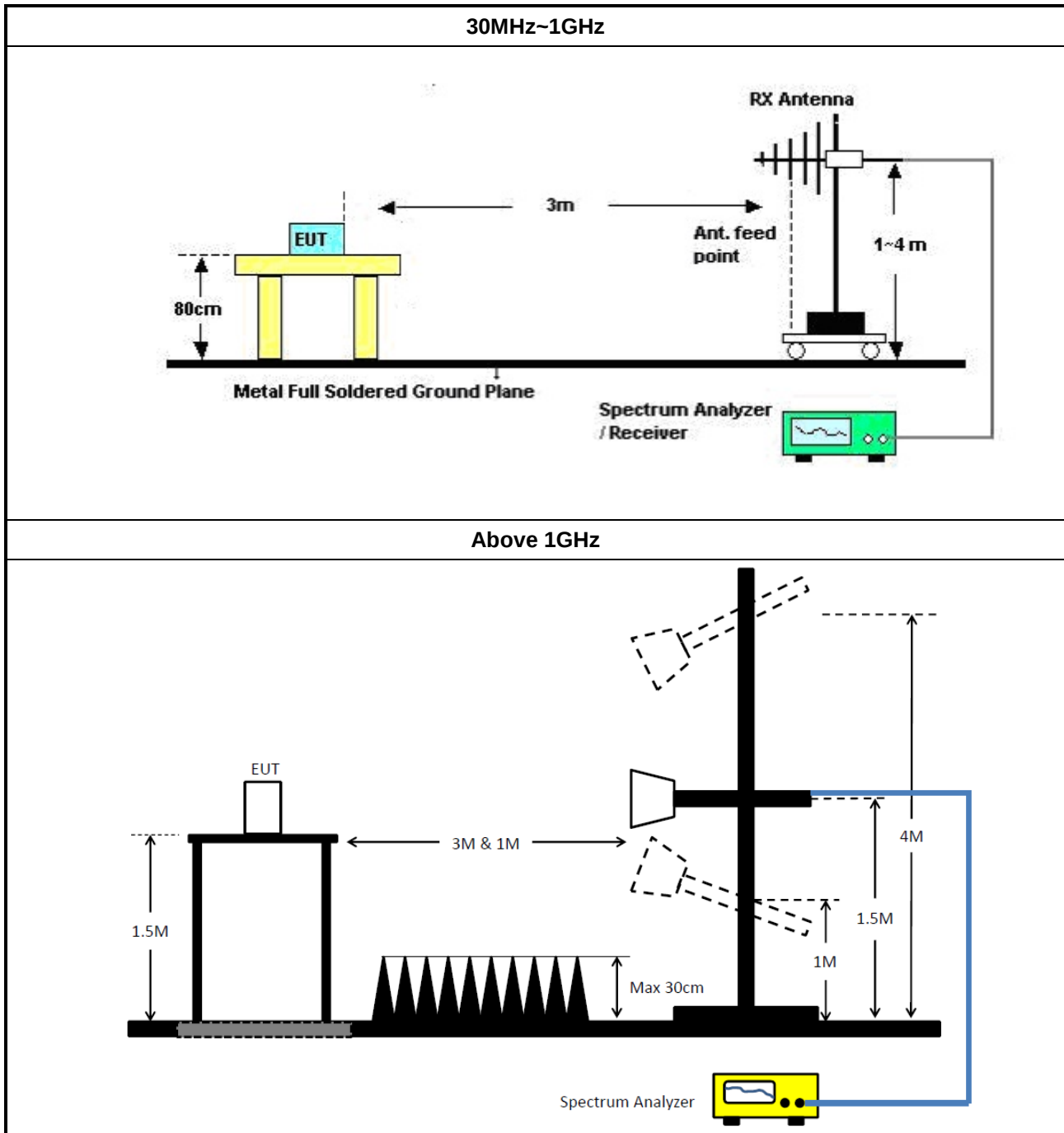
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

Test Method	
The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
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.	
For the transmitter unwanted emissions shall be measured using following options below:	
	Refer as KDB 558074, clause 8.6 (11.12 of ANSI C63.10) for restricted frequency bands.
For the transmitter band-edge emissions shall be measured using following options below:	
	Refer as KDB 558074 clause 8.7.1, 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.
	Refer as KDB 558074, clause 8.7.2 (6.10.6 of ANSI C63.10) for marker-delta method for band-edge measurements.
	Refer as KDB 558074, clause 8.7.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).

3.6.4 Test Setup





3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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

3.6.6 Test Result of Transmitter Radiated Unwanted Emissions

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	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
LISN	R&S	ENV216	101295	9kHz ~ 30MHz	08/Nov/2018	07/Nov/2019
RF Cable-CON	MTJ	RG142	CB002-CO	9kHz ~ 200MHz	17/Sep/2018	16/Sep/2019
AC POWER	APC	AFC-11005G	F310050055	47Hz~63Hz 5~300V	NCR	NCR
Impuls Begrenzer Pulse Limiter	SCHWARZBECK	VTSD 9561-F	9561-F041	9 kHz ~ 30 MHz	12/Oct/2018	11/Oct/2019

NCR : Non-Calibration Require

Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	10Hz~40GHz	13/Mar/2019	12/Mar/2020
Power Sensor	Anritsu	MA2411B	0917017	300MHz ~ 40GHz	19/Feb/2019	18/Feb/2020
Power Meter	Anritsu	ML2495A	0949003	300MHz ~ 40GHz	19/Feb/2019	18/Feb/2020
Cable 0.2m	HUBER	MY10710/4	RF Cable - 01	30MHz ~18G	10/Jan/2019	09/Jan/2020
Cable 0.2m	HUBER	MY10711/4	RF Cable - 02	30MHz ~18G	10/Jan/2019	09/Jan/2020
Cable 0.5m	HUBER	MY10714/4	RF Cable - 05	30MHz~1G	10/Jan/2019	09/Jan/2020
SMB100A Signal Generator	R&S	SMB100A03	181147	100kHz~40GHz	12/Nov/2018	10/Nov/2020

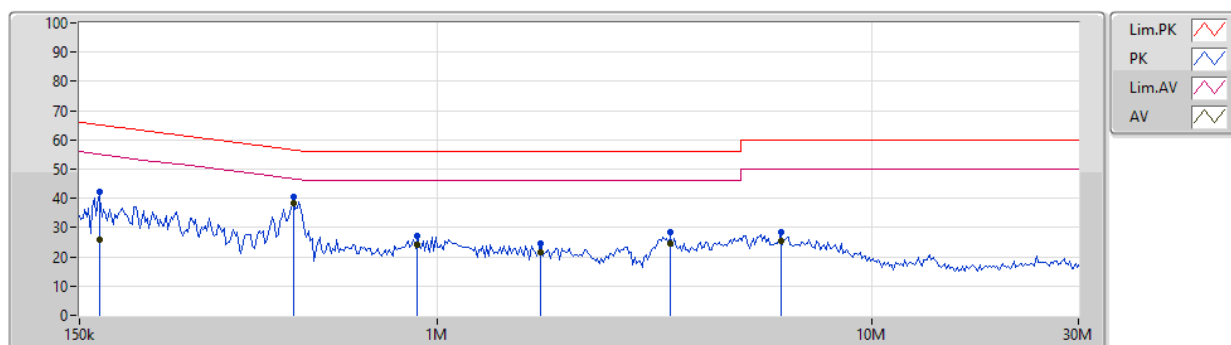
**Instrument for Radiated Test**

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	19/Oct/2018	18/Oct/2019
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	1GHz ~ 18GHz 3m	17/Oct/2018	16/Oct/2019
Amplifier	Agilent	8447D	2944A11149	100kHz ~ 1.3GHz	02Jul/2019	01/Jul/2020
Microwave Preamplifier	Agilent	8449B	3008A02373	1GHz ~ 26.5GHz	23/Oct/2018	22/Oct/2019
Spectrum Analyzer	Rohde & Schwarz	FSP40	100593	9KHz - 40GHz	27/Dec/2018	26/Dec/2019
EMI Test Receiver	R&S	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
RF Cable-R03m	Jye Bao	RG142	CB017	9kHz ~ 1GHz	26/Mar/2019	25/Mar/2020
RF Cable-high 6m	SUHNER	SUCOFLEX104	10567868 / SN805193/4	1GHz~40GHz	09/Apr/2019	08/Apr/2020
RF Cable-high 7m	SUHNER	SUCOFLEX104	10567868 / SN805192/4	1GHz~40GHz	09/Apr/2019	08/Apr/2020
Bilog Antenna & 5dB Attenuator	SCHAFFNER / MTJ	CBL 6112B / MTJ6102-05	2723 / 2	30MHz ~ 1GHz	08/Sep/2019	07/Sep/2020
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170221	15GHz ~ 40GHz	22/Mar/2019	21/Mar/2020
Preamplifier	MITEQ	TTA1840-35-HG	1864481	18GHz ~ 40GHz	05/Aug/2019	04/Aug/2020
Loop Antenna	TESEQ	HLA 6120	31244	9k-30MHz	15/Mar/2019	14/Mar/2020
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 01543	1GHz ~ 18GHz	03/Jun/2019	02/Jun/2020

AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Neutral
Operating Function	Adapter mode		

13/09/2019

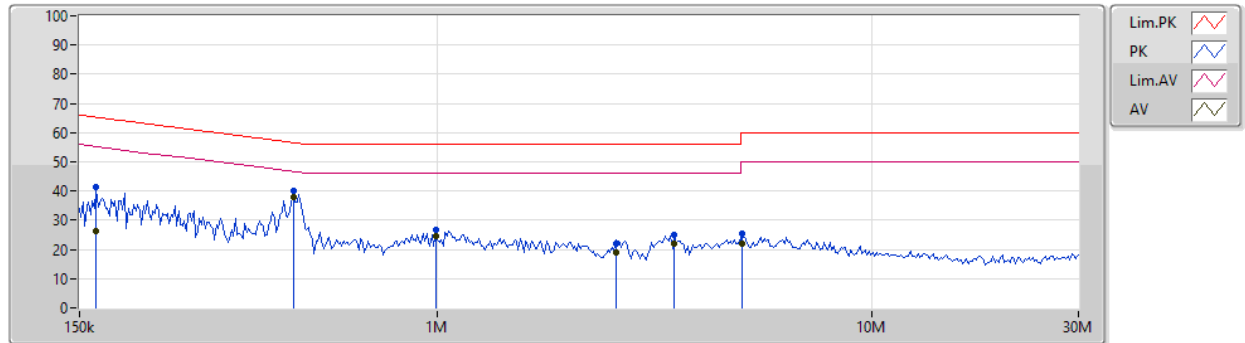


Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	167.35k	42.40	65.08	-22.68	19.48	Neutral	-	22.92	9.60	0.01	9.87			
AV	167.35k	25.96	55.08	-29.12	19.48	Neutral	-	6.48	9.60	0.01	9.87			
QP	466.367k	40.54	56.57	-16.03	19.48	Neutral	-	21.06	9.59	0.01	9.88			
AV	466.367k	38.29	46.57	-8.28	19.48	Neutral	"Worst"	18.81	9.59	0.01	9.88			
QP	899.37k	27.31	56.00	-28.69	19.49	Neutral	-	7.82	9.59	0.02	9.88			
AV	899.37k	24.28	46.00	-21.72	19.49	Neutral	-	4.79	9.59	0.02	9.88			
QP	1.734M	24.56	56.00	-31.44	19.53	Neutral	-	5.03	9.61	0.03	9.89			
AV	1.734M	21.53	46.00	-24.47	19.53	Neutral	-	2.00	9.61	0.03	9.89			
QP	3.446M	28.56	56.00	-27.44	19.54	Neutral	-	9.02	9.61	0.04	9.89			
AV	3.446M	24.74	46.00	-21.26	19.54	Neutral	-	5.20	9.61	0.04	9.89			
QP	6.198M	28.55	60.00	-31.45	19.59	Neutral	-	8.96	9.64	0.06	9.89			
AV	6.198M	25.27	50.00	-24.73	19.59	Neutral	-	5.68	9.64	0.06	9.89			

AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	Adapter mode		

13/09/2019

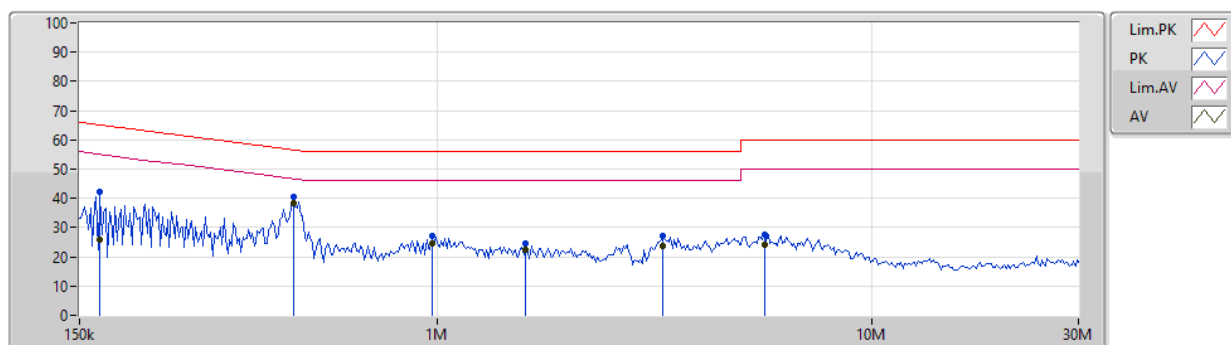


Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	164.053k	41.54	65.25	-23.71	19.48	Line	-	22.06	9.60	0.01	9.87			
AV	164.053k	26.16	55.25	-29.09	19.48	Line	-	6.68	9.60	0.01	9.87			
QP	466.367k	40.08	56.57	-16.49	19.48	Line	-	20.60	9.59	0.01	9.88			
AV	466.367k	37.82	46.57	-8.75	19.48	Line	"Worst"	18.34	9.59	0.01	9.88			
QP	993.464k	26.75	56.00	-29.25	19.50	Line	-	7.25	9.60	0.02	9.88			
AV	993.464k	24.68	46.00	-21.32	19.50	Line	-	5.18	9.60	0.02	9.88			
QP	2.582M	21.96	56.00	-34.04	19.55	Line	-	2.41	9.62	0.04	9.89			
AV	2.582M	18.97	46.00	-27.03	19.55	Line	-	-0.58	9.62	0.04	9.89			
QP	3.515M	25.17	56.00	-30.83	19.56	Line	-	5.61	9.63	0.04	9.89			
AV	3.515M	21.89	46.00	-24.11	19.56	Line	-	2.33	9.63	0.04	9.89			
QP	5.03M	25.41	60.00	-34.59	19.58	Line	-	5.83	9.64	0.05	9.89			
AV	5.03M	21.92	50.00	-28.08	19.58	Line	-	2.34	9.64	0.05	9.89			

AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Neutral
Operating Function	Adapter mode		

13/09/2019

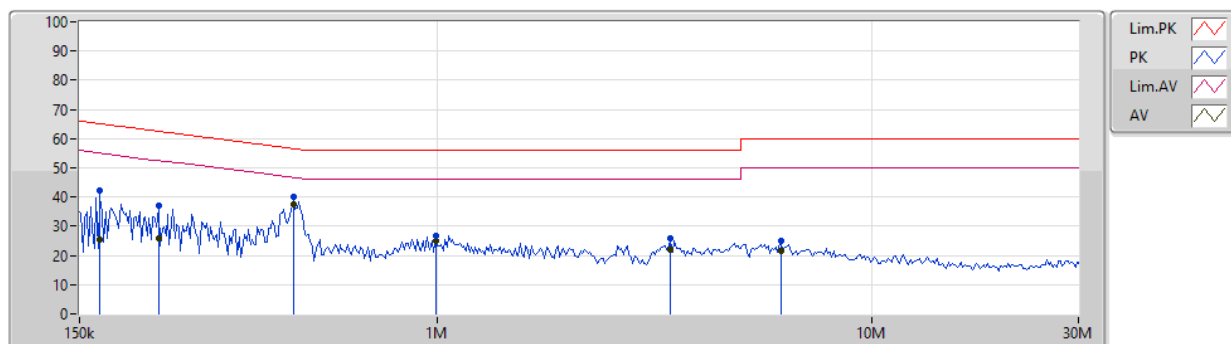


Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	167.35k	42.35	65.08	-22.73	19.48	Neutral	-	22.87	9.60	0.01	9.87			
AV	167.35k	25.89	55.08	-29.19	19.48	Neutral	-	6.41	9.60	0.01	9.87			
QP	466.367k	40.60	56.57	-15.97	19.48	Neutral	-	21.12	9.59	0.01	9.88			
AV	466.367k	38.33	46.57	-8.24	19.48	Neutral	"Worst"	18.85	9.59	0.01	9.88			
QP	973.889k	27.27	56.00	-28.73	19.49	Neutral	-	7.78	9.59	0.02	9.88			
AV	973.889k	24.63	46.00	-21.37	19.49	Neutral	-	5.14	9.59	0.02	9.88			
QP	1.602M	24.75	56.00	-31.25	19.52	Neutral	-	5.23	9.60	0.03	9.89			
AV	1.602M	22.23	46.00	-23.77	19.52	Neutral	-	2.71	9.60	0.03	9.89			
QP	3.312M	27.12	56.00	-28.88	19.54	Neutral	-	7.58	9.61	0.04	9.89			
AV	3.312M	23.57	46.00	-22.43	19.54	Neutral	-	4.03	9.61	0.04	9.89			
QP	5.668M	27.61	60.00	-32.39	19.57	Neutral	-	8.04	9.63	0.05	9.89			
AV	5.668M	24.30	50.00	-25.70	19.57	Neutral	-	4.73	9.63	0.05	9.89			

AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	Adapter mode		

13/09/2019



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	167.35k	42.10	65.08	-22.98	19.48	Line	-	22.62	9.60	0.01	9.87			
AV	167.35k	25.62	55.08	-29.46	19.48	Line	-	6.14	9.60	0.01	9.87			
QP	227.818k	36.96	62.52	-25.56	19.48	Line	-	17.48	9.60	0.01	9.87			
AV	227.818k	25.80	52.52	-26.72	19.48	Line	-	6.32	9.60	0.01	9.87			
QP	466.367k	39.96	56.57	-16.61	19.48	Line	-	20.48	9.59	0.01	9.88			
AV	466.367k	37.68	46.57	-8.89	19.48	Line	"Worst"	18.20	9.59	0.01	9.88			
QP	993.464k	26.77	56.00	-29.23	19.50	Line	-	7.27	9.60	0.02	9.88			
AV	993.464k	24.81	46.00	-21.19	19.50	Line	-	5.31	9.60	0.02	9.88			
QP	3.446M	26.00	56.00	-30.00	19.56	Line	-	6.44	9.63	0.04	9.89			
AV	3.446M	22.01	46.00	-23.99	19.56	Line	-	2.45	9.63	0.04	9.89			
QP	6.198M	25.16	60.00	-34.84	19.60	Line	-	5.56	9.65	0.06	9.89			
AV	6.198M	21.68	50.00	-28.32	19.60	Line	-	2.08	9.65	0.06	9.89			

**Summary**

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
902-928MHz	-	-	-	-	-
DSSS_Nss1_1TX	541k	734.633k	735KD1D	537k	717.641k

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)
DSSS_Nss1_1TX	-	-	-	-
902.8MHz	Pass	500k	539k	734.633k
915MHz	Pass	500k	537k	717.641k
927.4MHz	Pass	500k	541k	729.635k

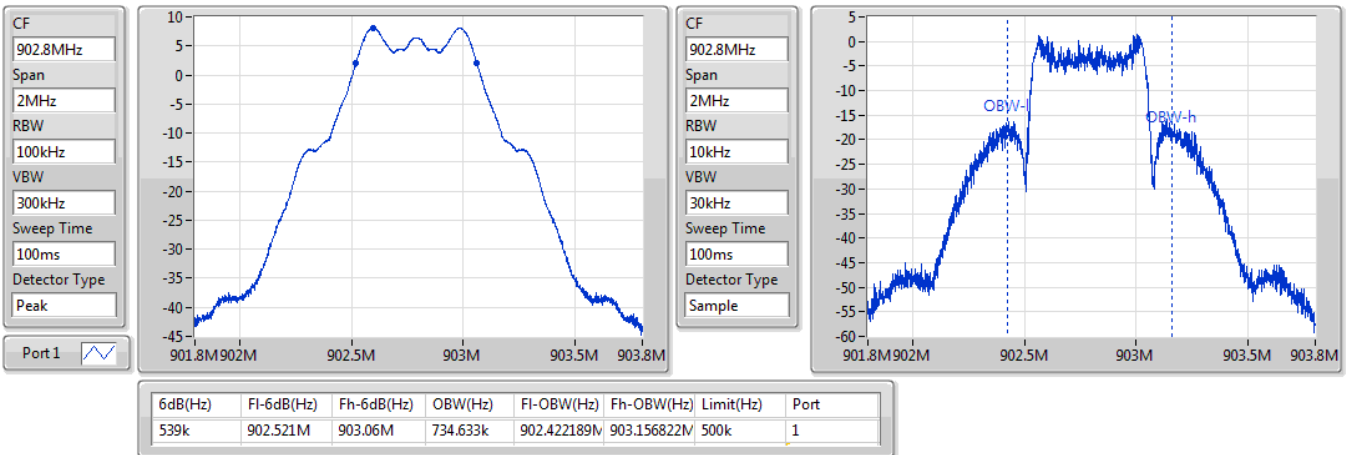
Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

DSSS_Nss1_1TX

902.8MHz

EBW

01/10/2019

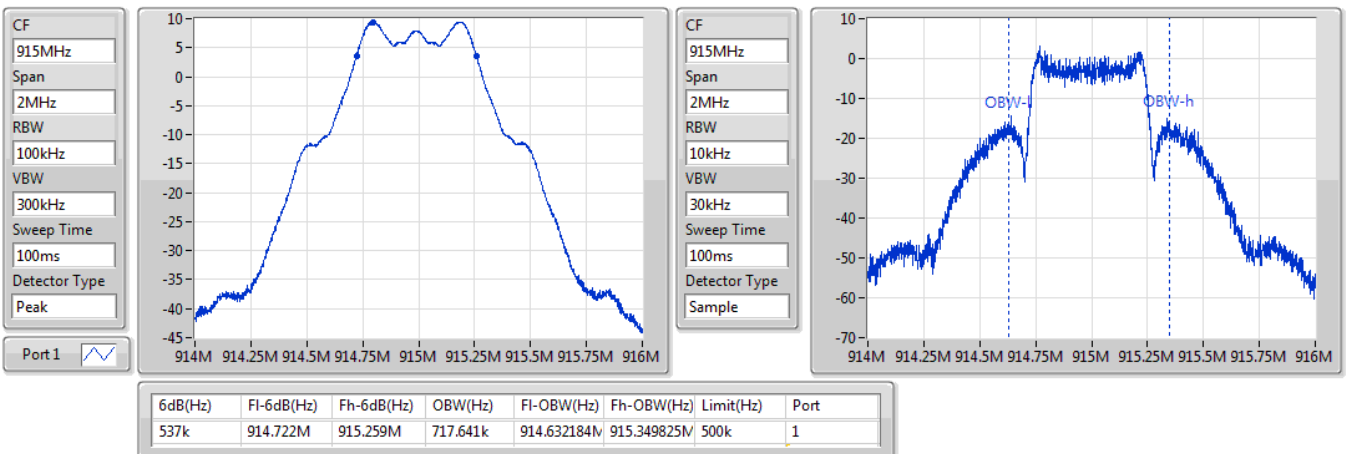


DSSS_Nss1_1TX

915MHz

EBW

20/09/2019

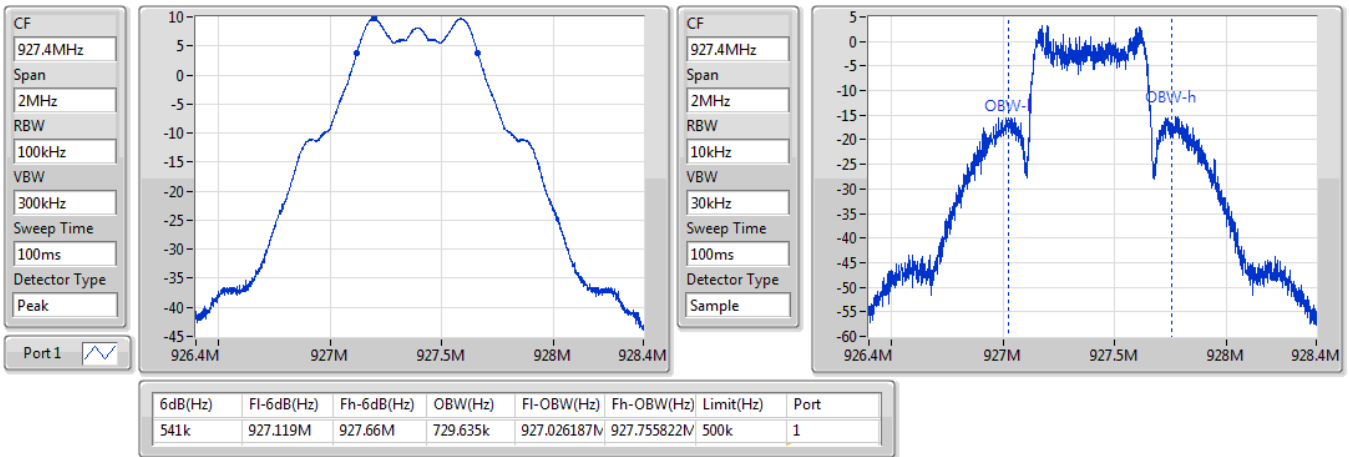


DSSS_Nss1_1TX

927.4MHz

EBW

20/09/2019



**Summary**

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
902-928MHz	-	-	-	-	-
DSSS_Nss1_1TX	542k	743.628k	744KD1D	536k	703.648k

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)
DSSS_Nss1_1TX	-	-	-	-
902.8MHz_TnomVnom	Pass	500k	536k	729.635k
915MHz_TnomVnom	Pass	500k	537k	703.648k
927.4MHz_TnomVnom	Pass	500k	542k	743.628k

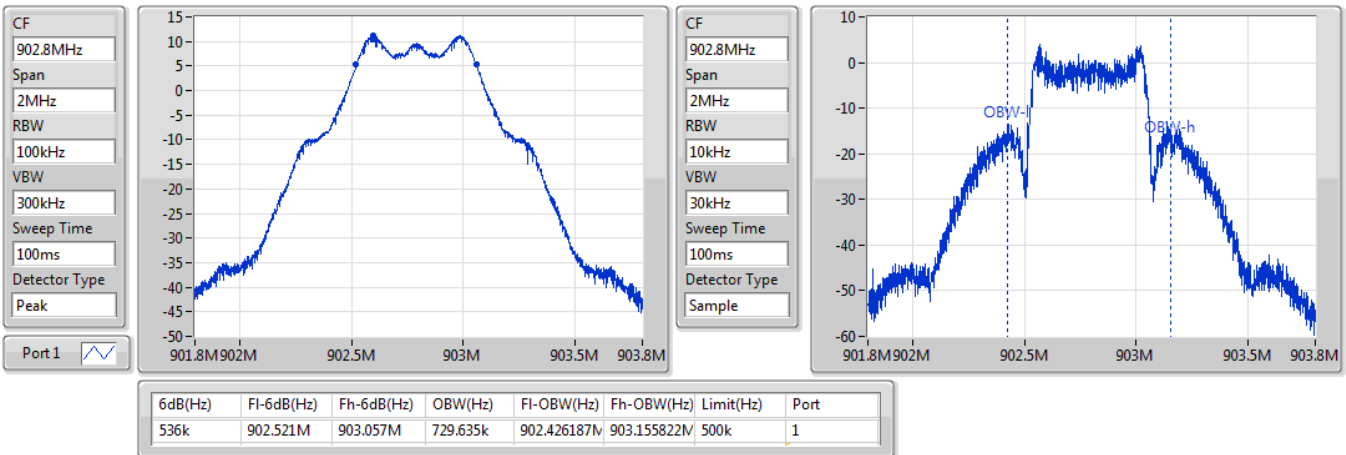
Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

DSSS_Nss1_1TX

902.8MHz

EBW

20/09/2019

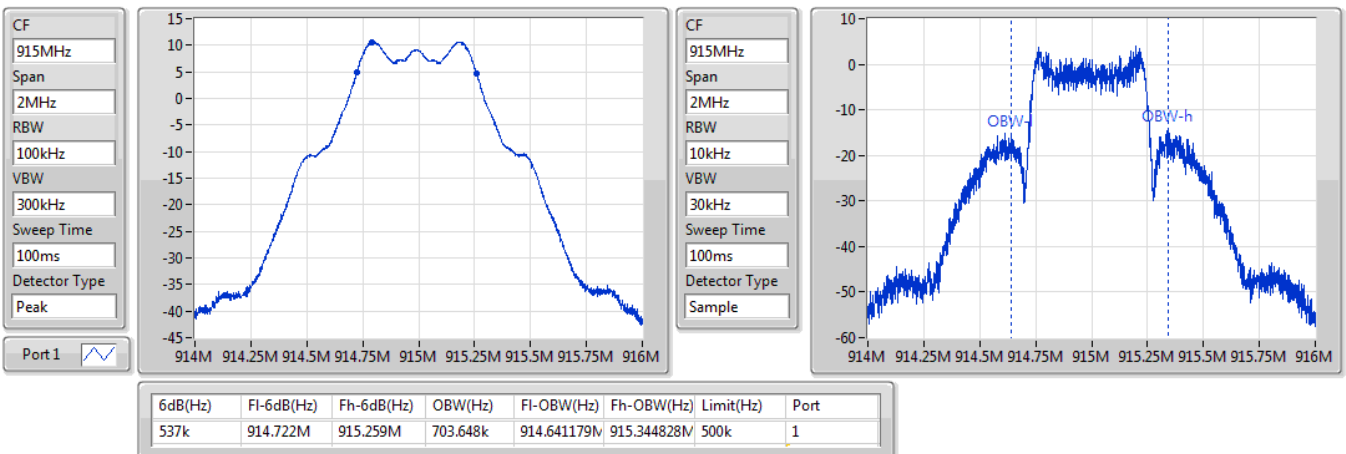


DSSS_Nss1_1TX

915MHz

EBW

20/09/2019

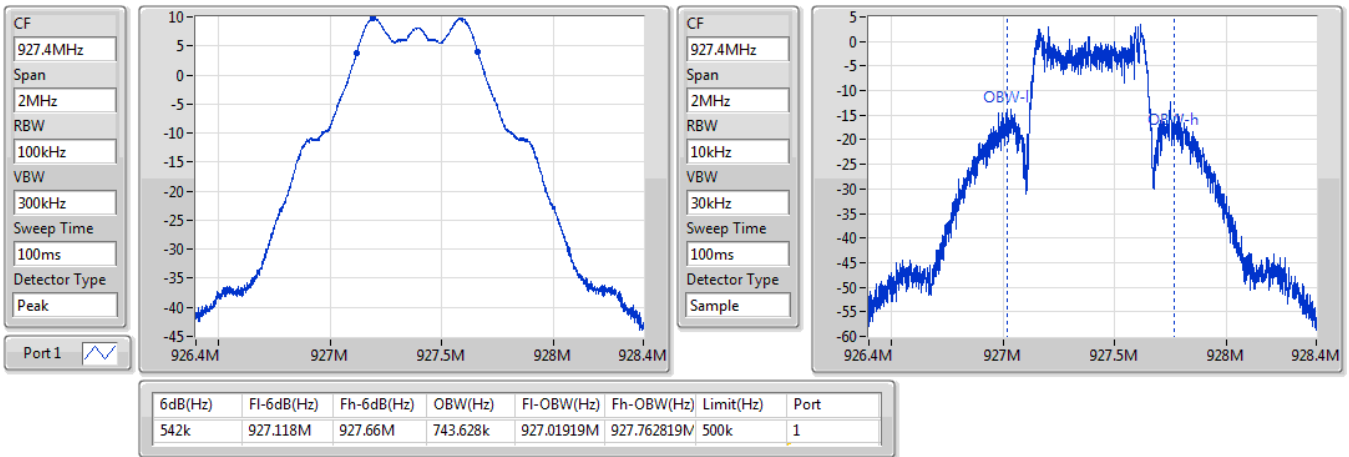


DSSS_Nss1_1TX

927.4MHz

EBW

20/09/2019





Summary

Mode	Power (dBm)	Power (W)
902-928MHz	-	-
DSSS_Nss1_1TX	9.24	0.00839



Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
DSSS_Nss1_1TX	-	-	-	-
902.8MHz	Pass	0.01	8.91	30.00
915MHz	Pass	0.01	9.00	30.00
927.4MHz	Pass	0.01	9.24	30.00

DG = Directional Gain; **Port X** = Port X output power



MAXIMUM CONDUCTED OUTPUT POWER_External Antenna *Appendix C.2*

Summary

Mode	Power (dBm)	Power (W)
902-928MHz	-	-
DSSS_Nss1_1TX	11.56	0.01432



MAXIMUM CONDUCTED OUTPUT POWER_External Antenna *Appendix C.2*

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
DSSS_Nss1_1TX	-	-	-	-
902.8MHz_TnomVnom	Pass	0.90	11.56	30.00
915MHz_TnomVnom	Pass	0.90	11.07	30.00
927.4MHz_TnomVnom	Pass	0.90	10.24	30.00

DG = Directional Gain; **Port X** = Port X output power



Summary

Mode	PD (dBm/RBW)
902-928MHz	-
DSSS_Nss1_1TX	-3.18

RBW=3 kHz.



Result

Mode	Result	Gain (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
DSSS_Nss1_1TX	-	-	-	-
902.8MHz	Pass	0.01	-3.95	8.00
915MHz	Pass	0.01	-3.77	8.00
927.4MHz	Pass	0.01	-3.18	8.00

DG = Directional Gain; RBW=3 kHz;

PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

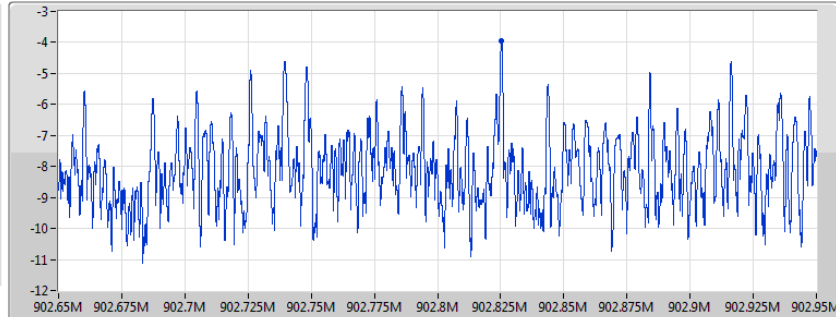
DSSS_Nss1_1TX

PSD

902.8MHz

01/10/2019

CF
902.8MHz
Span
300kHz
RBW
3kHz
VBW
10kHz
Sweep Time
32.1ms
Detector Type
RMS



Port 1

Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-3.95	-3.95	-3.95

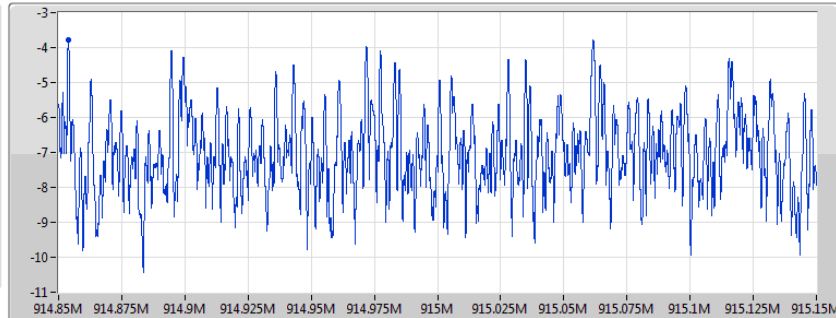
DSSS_Nss1_1TX

PSD

915MHz

20/09/2019

CF
915MHz
Span
300kHz
RBW
3kHz
VBW
10kHz
Sweep Time
32.1ms
Detector Type
RMS



Port 1

Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-3.77	-3.77	-3.77

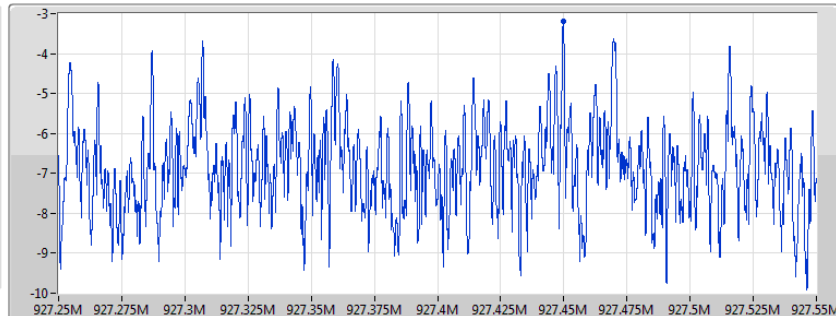
DSSS_Nss1_1TX

PSD

927.4MHz

20/09/2019

CF
927.4MHz
Span
300kHz
RBW
3kHz
VBW
10kHz
Sweep Time
32.1ms
Detector Type
RMS



Port 1

Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-3.18	-3.18	-3.18



Summary

Mode	PD (dBm/RBW)
902-928MHz	-
DSSS_Nss1_1TX	-2.07

RBW=3 kHz.



Result

Mode	Result	Gain (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
DSSS_Nss1_1TX	-	-	-	-
902.8MHz_TnomVnom	Pass	0.90	-2.07	8.00
915MHz_TnomVnom	Pass	0.90	-2.07	8.00
927.4MHz_TnomVnom	Pass	0.90	-2.38	8.00

DG = Directional Gain; RBW=3 kHz;

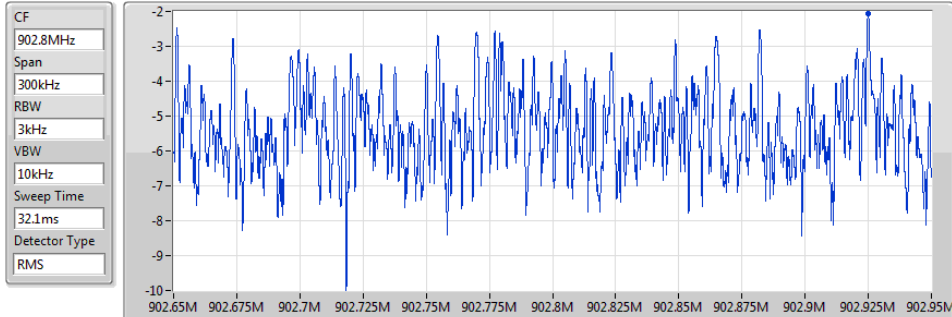
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

DSSS_Nss1_1TX

PSD

902.8MHz

20/09/2019



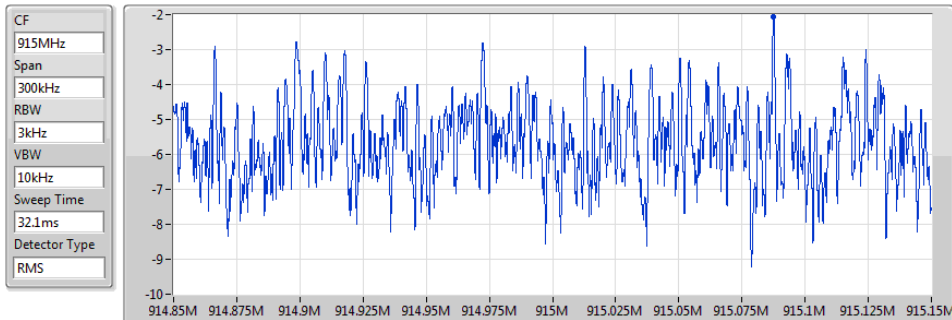
Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-2.07	-2.07	-2.07

DSSS_Nss1_1TX

PSD

915MHz

20/09/2019



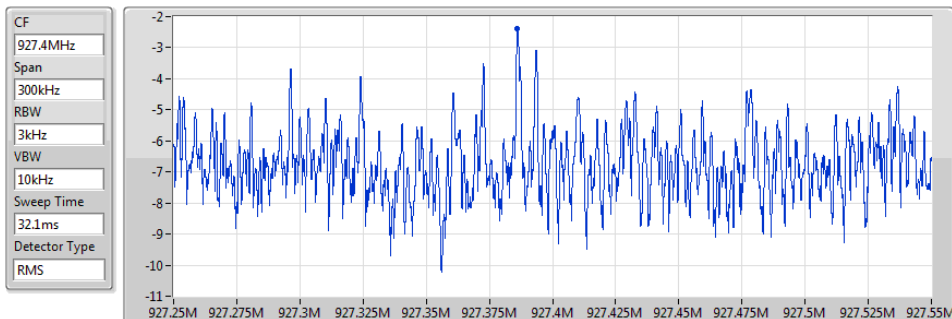
Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-2.07	-2.07	-2.07

DSSS_Nss1_1TX

PSD

927.4MHz

20/09/2019



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-2.38	-2.38	-2.38



EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS_
Internal Antenna

Appendix E.1

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
902-928MHz	-	-	-	-	-	-	-	-	-	-	-	-	-
DSSS_Nss1_1TX	Pass	927.6M	8.10	-21.90	463.73M	-56.27	901.75M	-56.48	928M	-24.94	7.13564G	-45.78	1

Result

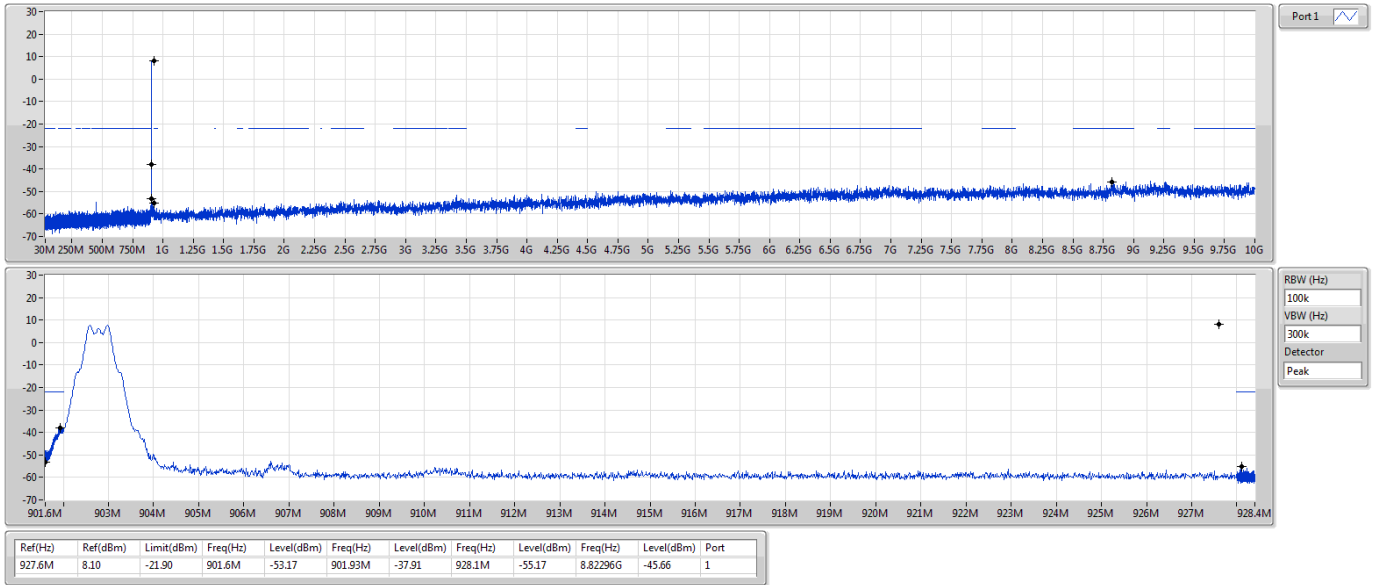
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
DSSS_Nss1_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
902.8MHz	Pass	927.6M	8.10	-21.90	901.6M	-53.17	901.93M	-37.91	928.1M	-55.17	8.82296G	-45.66	1
915MHz	Pass	927.6M	8.10	-21.90	457.41M	-55.29	901.7M	-56.38	928.27M	-56.00	8.83657G	-46.31	1
927.4MHz	Pass	927.6M	8.10	-21.90	463.73M	-56.27	901.75M	-56.48	928M	-24.94	7.13564G	-45.78	1

DSSS_Nss1_1TX

CSE NdB

902.8MHz

01/10/2019

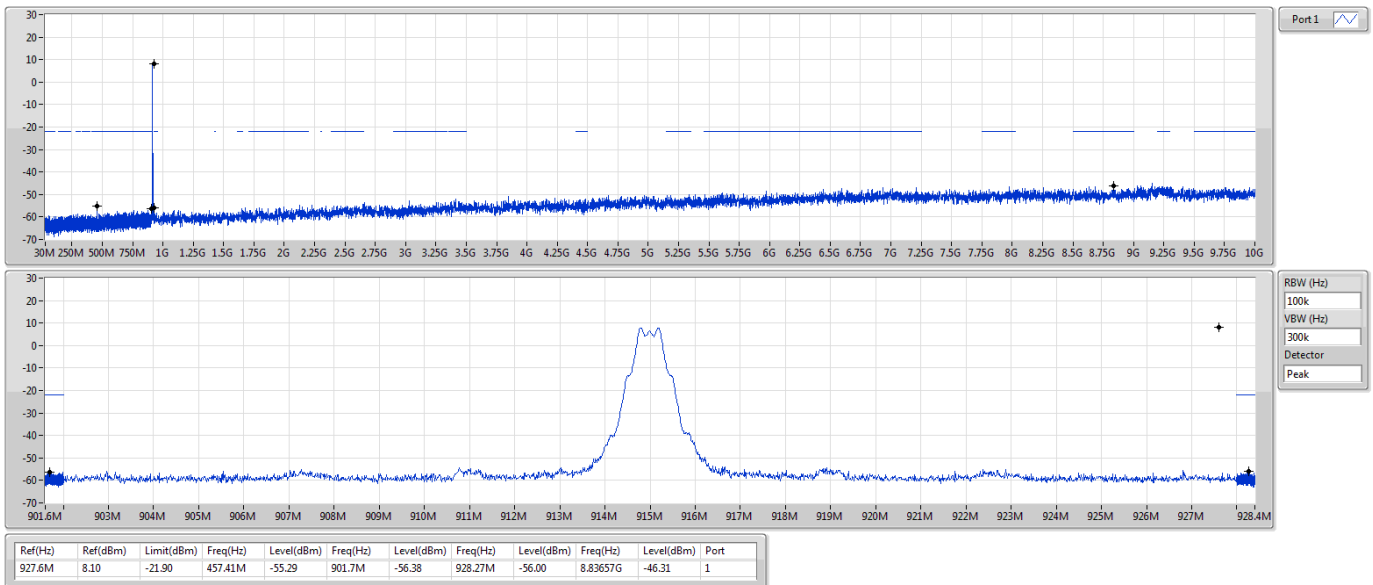


DSSS_Nss1_1TX

CSE NdB

915MHz

01/10/2019



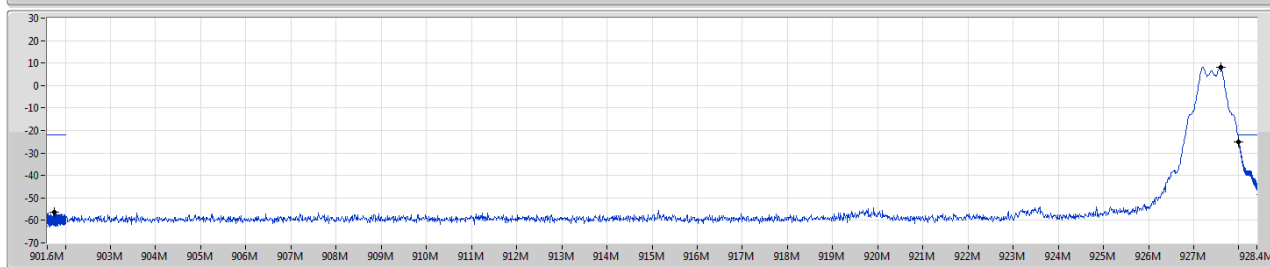
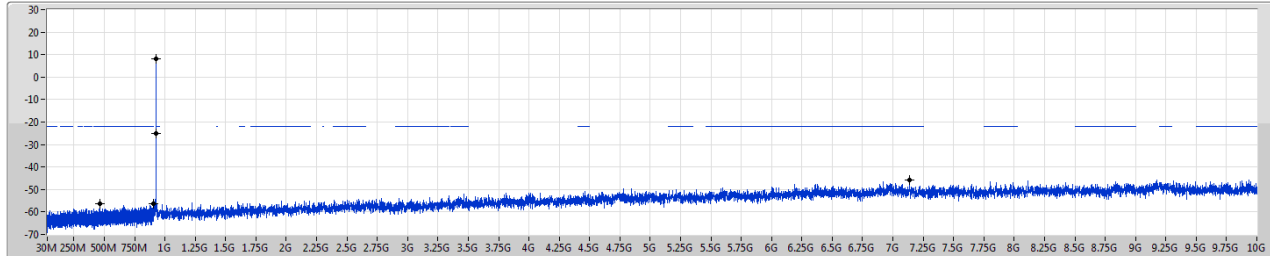
DSSS_Nss1_1TX

927.4MHz

CSE NdB

01/10/2019

Port1



RBW (Hz)
 100k
 VBW (Hz)
 300k
 Detector
 Peak

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
927.6M	8.10	-21.90	463.73M	-56.27	901.75M	-56.48	928M	-24.94	7.13564G	-45.78	1



EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS
External Antenna

Appendix E.2

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
902-928MHz	-	-	-	-	-	-	-	-	-	-	-	-	-
DSSS_Nss1_1TX	Pass	902.6M	10.95	-19.05	463.84M	-50.98	901.65M	-56.55	928M	-23.69	928.4M	-46.64	1

Result

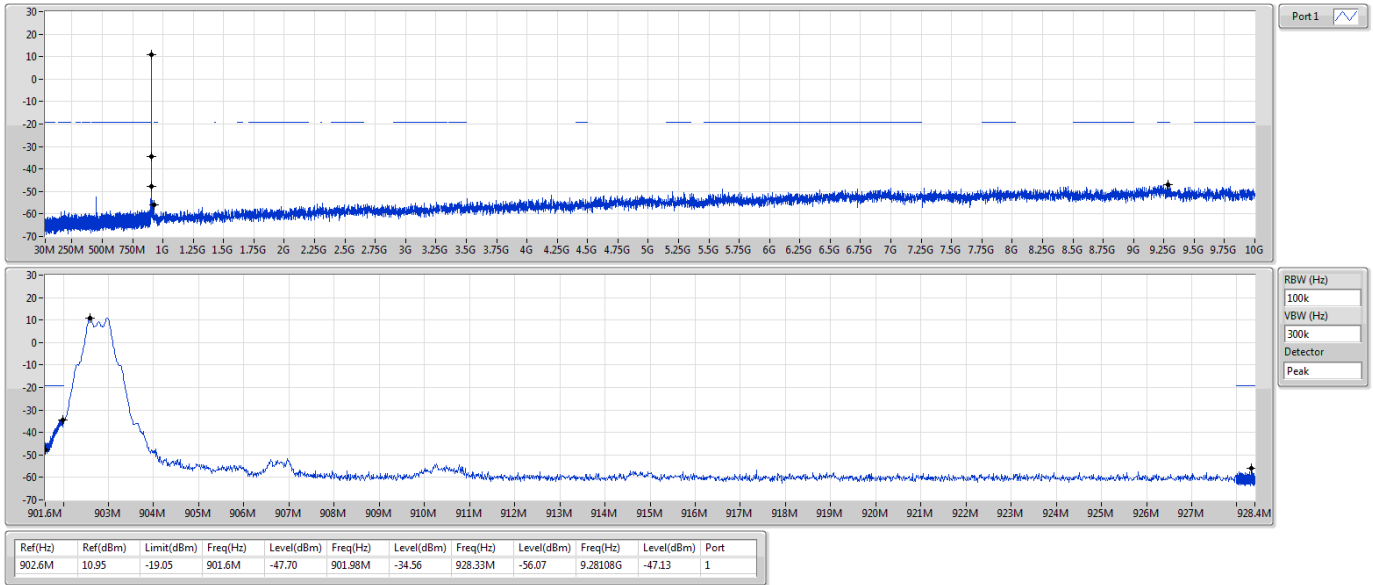
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
DSSS_Nss1_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
902.8MHz_TnomVnom	Pass	902.6M	10.95	-19.05	901.6M	-47.70	901.98M	-34.56	928.33M	-56.07	9.28108G	-47.13	1
915MHz_TnomVnom	Pass	902.6M	10.95	-19.05	457.52M	-50.65	901.7M	-57.00	928.38M	-57.21	9.20964G	-46.70	1
927.4MHz_TnomVnom	Pass	902.6M	10.95	-19.05	463.84M	-50.98	901.65M	-56.55	928M	-23.69	928.4M	-46.64	1

DSSS_Nss1_1TX

CSE NdB

902.8MHz

20/09/2019

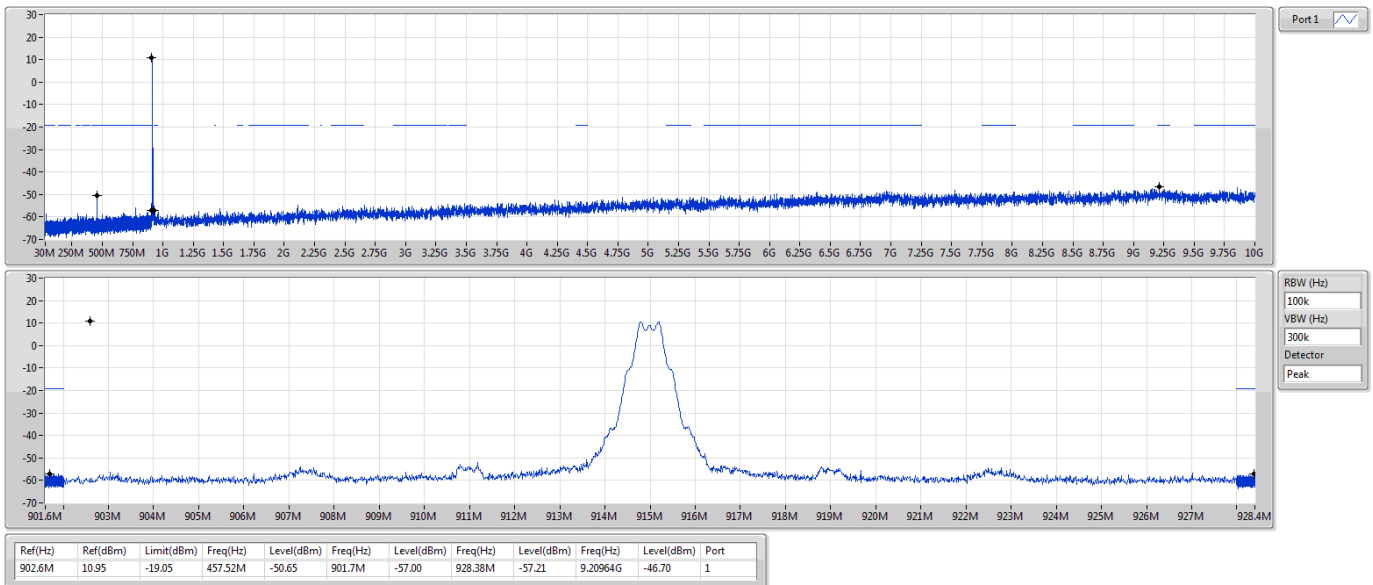


DSSS_Nss1_1TX

CSE NdB

915MHz

20/09/2019



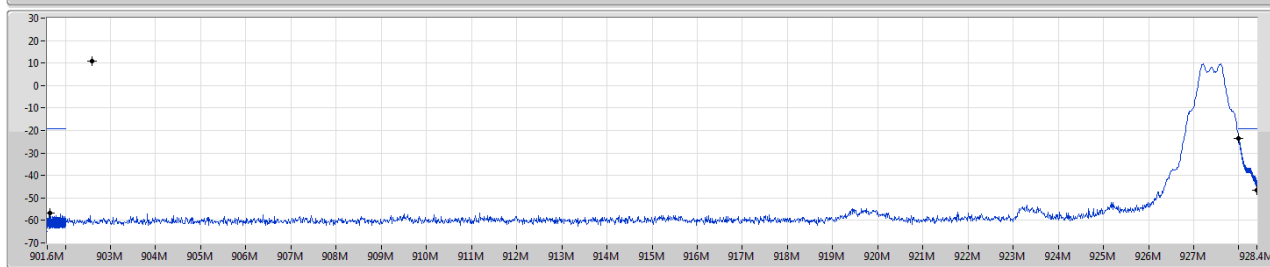
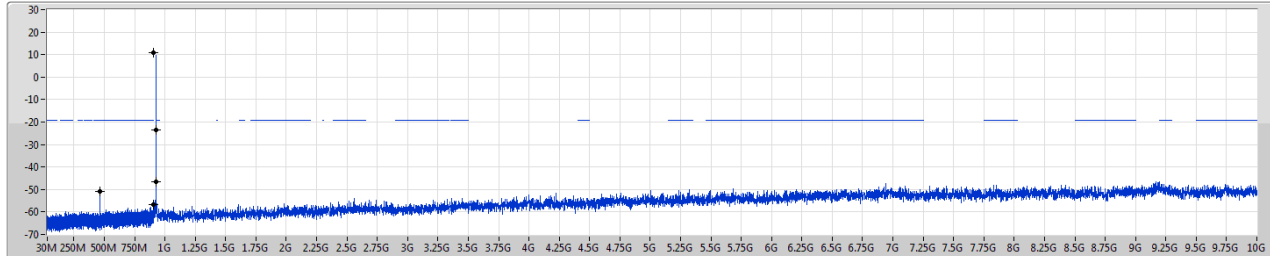
DSSS_Nss1_1TX

CSE NdB

927.4MHz

20/09/2019

Port1



RBW (Hz)
 100k
 VBW (Hz)
 300k
 Detector
 Peak

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
902.6M	10.95	-19.05	463.84M	-50.98	901.65M	-56.55	928M	-23.69	928.4M	-46.64	1



EMISSIONS IN RESTRICTED FREQUENCY BANDS

Internal Antenna

Appendix F.1

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
902-928MHz	-	-	-	-	-	-	-	-	-	-	-
LoRa (200kHz)	Pass	PK	66.86M	33.52	40.00	-6.48	3	Vertical	0	1.00	-

Remark :

Page No. : F1 of F4

Level (dBuV/m) = Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor)

990210

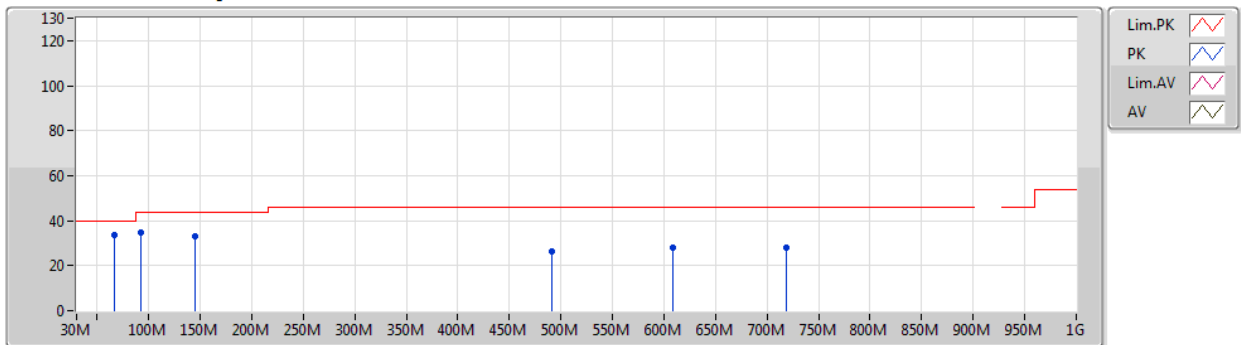
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
LoRa (200kHz)	-	-	-	-	-	-	-	-	-	-	-
915MHz_Adapter	Pass	PK	66.86M	33.52	40.00	-6.48	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	92.08M	34.88	43.50	-8.62	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	144.46M	33.09	43.50	-10.41	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	491.72M	26.30	46.00	-19.70	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	608.12M	27.76	46.00	-18.24	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	718.7M	27.95	46.00	-18.05	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	61.04M	31.36	40.00	-8.64	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	152.22M	22.19	43.50	-21.31	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	256.98M	29.83	46.00	-16.17	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	307.42M	28.34	46.00	-17.66	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	458.74M	25.35	46.00	-20.65	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	569.32M	26.61	46.00	-19.39	3	Horizontal	360	1.00	-

LoRa (200kHz)

915MHz_Adapter

13/09/2019

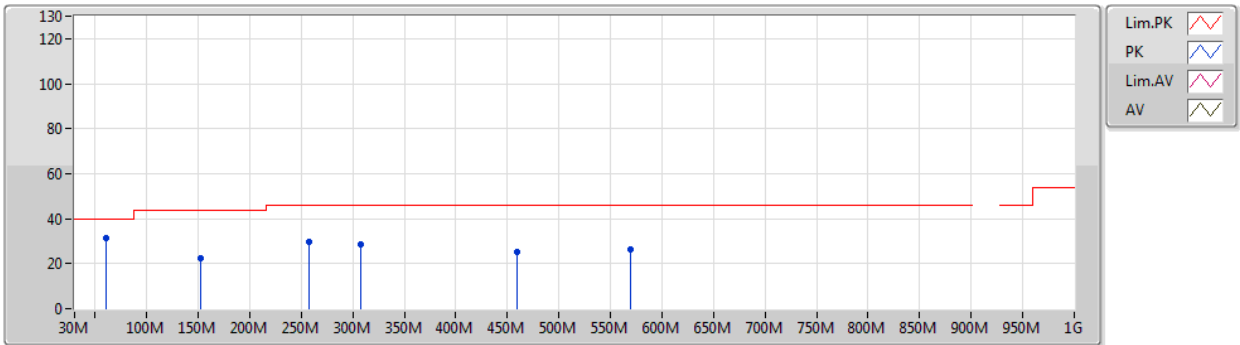


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	66.86M	33.52	40.00	-6.48	-19.56	3	Vertical	0	1.00	-	53.08	11.20	1.34	32.10
PK	92.08M	34.88	43.50	-8.62	-16.15	3	Vertical	0	1.00	-	51.03	14.47	1.49	32.11
PK	144.46M	33.09	43.50	-10.41	-14.33	3	Vertical	0	1.00	-	47.42	15.99	1.76	32.08
PK	491.72M	26.30	46.00	-19.70	-5.85	3	Vertical	0	1.00	-	32.15	22.60	3.19	31.64
PK	608.12M	27.76	46.00	-18.24	-4.11	3	Vertical	0	1.00	-	31.87	23.93	3.47	31.51
PK	718.7M	27.95	46.00	-18.05	-3.16	3	Vertical	0	1.00	-	31.11	24.37	3.82	31.35

LoRa (200kHz)

13/09/2019

915MHz_Adapter



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	61.04M	31.36	40.00	-8.64	-19.59	3	Horizontal	360	1.00	-	50.95	11.20	1.30	32.09
PK	152.22M	22.19	43.50	-21.31	-14.76	3	Horizontal	360	1.00	-	36.95	15.52	1.80	32.08
PK	256.98M	29.83	46.00	-16.17	-11.07	3	Horizontal	360	1.00	-	40.90	18.75	2.18	32.00
PK	307.42M	28.34	46.00	-17.66	-11.08	3	Horizontal	360	1.00	-	39.42	18.46	2.41	31.95
PK	458.74M	25.35	46.00	-20.65	-6.52	3	Horizontal	360	1.00	-	31.87	22.24	2.99	31.75
PK	569.32M	26.61	46.00	-19.39	-4.43	3	Horizontal	360	1.00	-	31.04	23.85	3.34	31.62



EMISSIONS IN RESTRICTED FREQUENCY BANDS

Internal Antenna

Appendix F.2

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
902-928MHz	-	-	-	-	-	-	-	-	-	-	-
LoRa (200kHz)	Pass	AV	3.66008G	29.45	54.00	-24.55	3	Horizontal	55	1.50	-

Remark :

Page No. : F1 of F8

Level (dBuV/m) = Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor)

990210

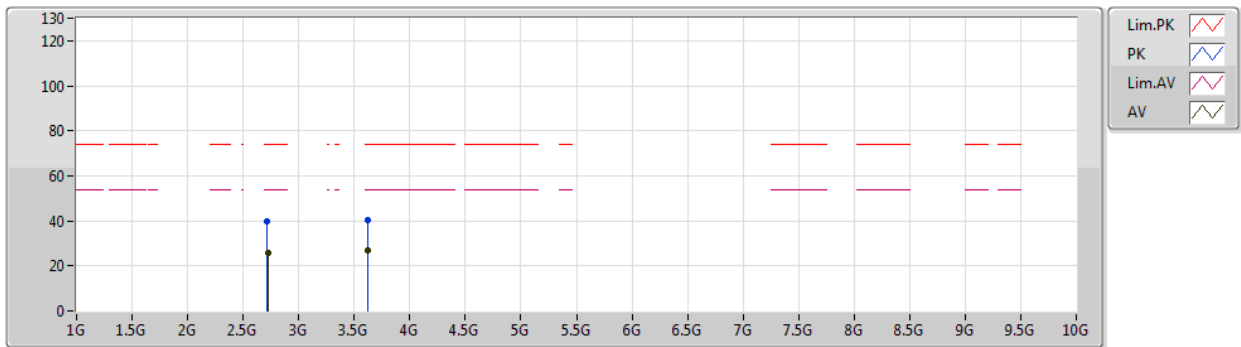
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
LoRa (200kHz)	-	-	-	-	-	-	-	-	-	-	-
902.8MHz	Pass	AV	2.72322G	25.77	54.00	-28.23	3	Vertical	67	1.50	-
902.8MHz	Pass	AV	3.62428G	26.75	54.00	-27.25	3	Vertical	22	1.69	-
902.8MHz	Pass	PK	2.70834G	39.75	74.00	-34.25	3	Vertical	67	1.50	-
902.8MHz	Pass	PK	3.61876G	40.61	74.00	-33.39	3	Vertical	22	1.69	-
902.8MHz	Pass	AV	2.72304G	25.80	54.00	-28.20	3	Horizontal	65	1.95	-
902.8MHz	Pass	AV	3.62446G	26.73	54.00	-27.27	3	Horizontal	334	1.49	-
902.8MHz	Pass	PK	2.71242G	39.87	74.00	-34.13	3	Horizontal	65	1.95	-
902.8MHz	Pass	PK	3.6055G	40.73	74.00	-33.27	3	Horizontal	334	1.49	-
915MHz	Pass	AV	2.7442G	27.29	54.00	-26.71	3	Vertical	250	1.99	-
915MHz	Pass	AV	3.66036G	29.38	54.00	-24.62	3	Vertical	317	1.50	-
915MHz	Pass	PK	2.74511G	40.17	74.00	-33.83	3	Vertical	250	1.99	-
915MHz	Pass	PK	3.66024G	42.15	74.00	-31.85	3	Vertical	317	1.50	-
915MHz	Pass	AV	2.74402G	27.23	54.00	-26.77	3	Horizontal	159	1.52	-
915MHz	Pass	AV	3.66008G	29.45	54.00	-24.55	3	Horizontal	55	1.50	-
915MHz	Pass	PK	2.74533G	40.44	74.00	-33.56	3	Horizontal	159	1.52	-
915MHz	Pass	PK	3.65947G	42.63	74.00	-31.37	3	Horizontal	55	1.50	-
927.4MHz	Pass	AV	2.78395G	27.15	54.00	-26.85	3	Vertical	347	1.34	-
927.4MHz	Pass	AV	3.71196G	29.45	54.00	-24.55	3	Vertical	285	1.46	-
927.4MHz	Pass	PK	2.78332G	40.35	74.00	-33.65	3	Vertical	347	1.34	-
927.4MHz	Pass	PK	3.71162G	43.10	74.00	-30.90	3	Vertical	285	1.46	-
927.4MHz	Pass	AV	2.78364G	27.09	54.00	-26.91	3	Horizontal	46	1.46	-
927.4MHz	Pass	AV	3.71199G	29.45	54.00	-24.55	3	Horizontal	267	1.22	-
927.4MHz	Pass	PK	2.7829G	40.20	74.00	-33.80	3	Horizontal	46	1.46	-
927.4MHz	Pass	PK	3.71103G	42.65	74.00	-31.35	3	Horizontal	267	1.22	-

LoRa (200kHz)

28/09/2019

902.8MHz_TX

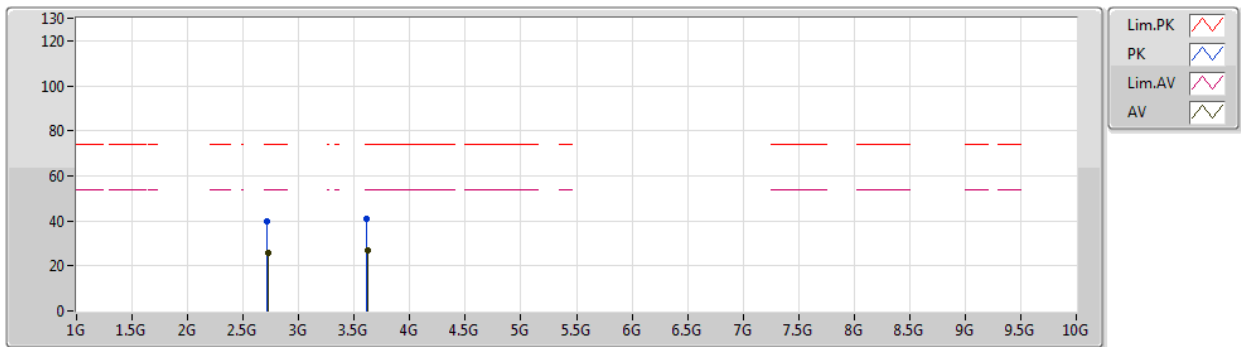


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.72322G	25.77	54.00	-28.23	-1.45	3	Vertical	67	1.50	-	27.22	28.06	5.12	34.63
AV	3.62428G	26.75	54.00	-27.25	0.34	3	Vertical	22	1.69	-	26.41	29.02	5.95	34.63
PK	2.70834G	39.75	74.00	-34.25	-1.49	3	Vertical	67	1.50	-	41.24	28.03	5.10	34.62
PK	3.61876G	40.61	74.00	-33.39	0.32	3	Vertical	22	1.69	-	40.29	29.01	5.94	34.63

LoRa (200kHz)

28/09/2019

902.8MHz_TX

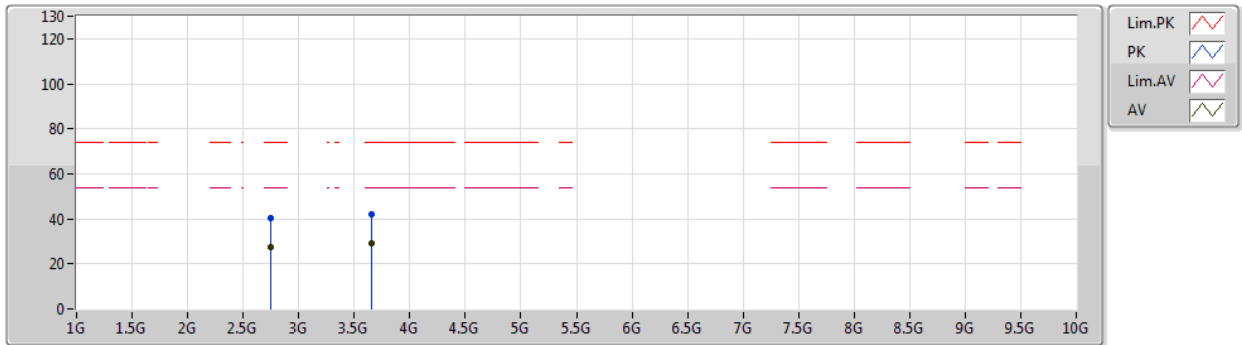


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.72304G	25.80	54.00	-28.20	-1.45	3	Horizontal	65	1.95	-	27.25	28.06	5.12	34.63
AV	3.62446G	26.73	54.00	-27.27	0.34	3	Horizontal	334	1.49	-	26.39	29.02	5.95	34.63
PK	2.71242G	39.87	74.00	-34.13	-1.48	3	Horizontal	65	1.95	-	41.35	28.04	5.10	34.62
PK	3.6055G	40.73	74.00	-33.27	0.27	3	Horizontal	334	1.49	-	40.46	28.99	5.91	34.63

LoRa (200kHz)

13/09/2019

915MHz_TX

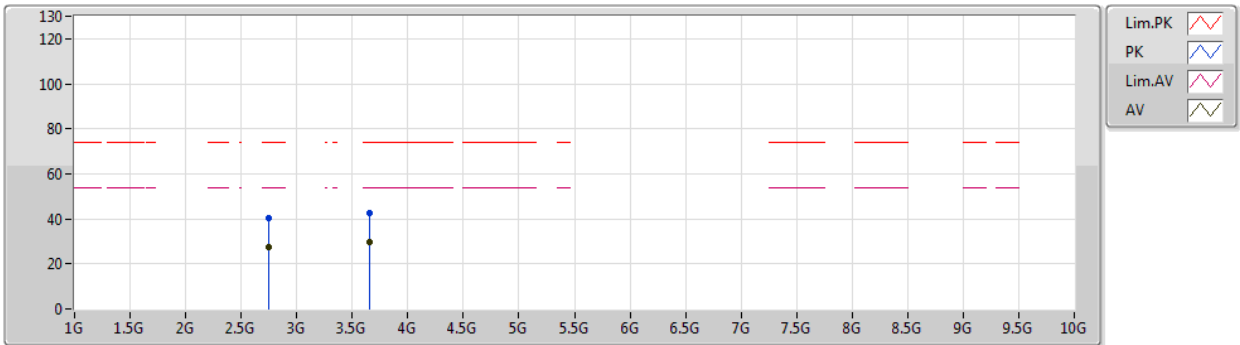


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.7442G	27.29	54.00	-26.71	-3.25	3	Vertical	250	1.99	-	30.54	28.03	4.04	35.32
AV	3.66036G	29.38	54.00	-24.62	-0.79	3	Vertical	317	1.50	-	30.17	29.22	5.15	35.16
PK	2.74511G	40.17	74.00	-33.83	-3.24	3	Vertical	250	1.99	-	43.41	28.04	4.04	35.32
PK	3.66024G	42.15	74.00	-31.85	-0.79	3	Vertical	317	1.50	-	42.94	29.22	5.15	35.16

LoRa (200kHz)

13/09/2019

915MHz_TX

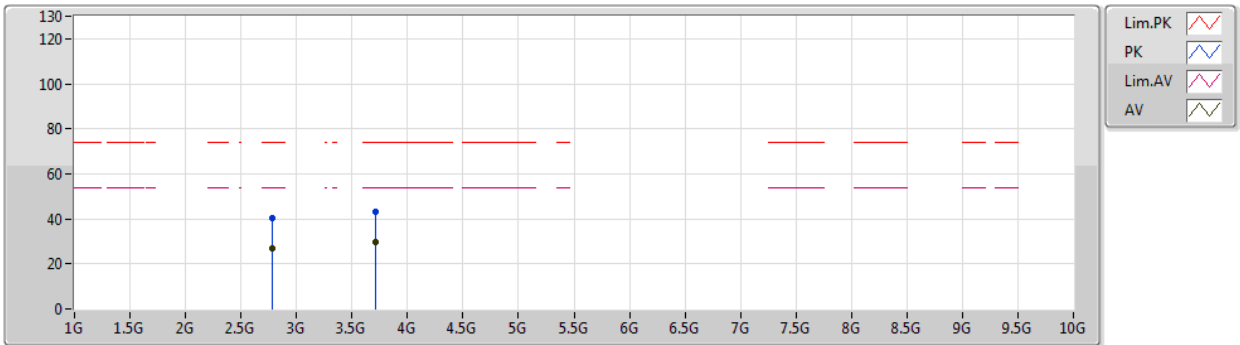


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.74402G	27.23	54.00	-26.77	-3.25	3	Horizontal	159	1.52	-	30.48	28.03	4.04	35.32
AV	3.66008G	29.45	54.00	-24.55	-0.79	3	Horizontal	55	1.50	-	30.24	29.22	5.15	35.16
PK	2.74533G	40.44	74.00	-33.56	-3.24	3	Horizontal	159	1.52	-	43.68	28.04	4.04	35.32
PK	3.65947G	42.63	74.00	-31.37	-0.79	3	Horizontal	55	1.50	-	43.42	29.22	5.15	35.16

LoRa (200kHz)

13/09/2019

927.4MHz_TX

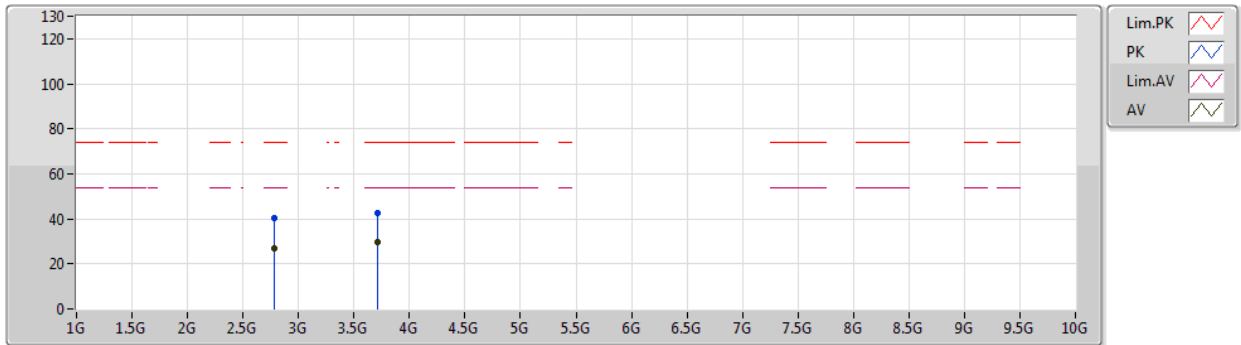


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.78395G	27.15	54.00	-26.85	-3.09	3	Vertical	347	1.34	-	30.24	28.15	4.10	35.34
AV	3.71196G	29.45	54.00	-24.55	-0.64	3	Vertical	285	1.46	-	30.09	29.31	5.20	35.15
PK	2.78332G	40.35	74.00	-33.65	-3.08	3	Vertical	347	1.34	-	43.43	28.15	4.10	35.33
PK	3.71162G	43.10	74.00	-30.90	-0.64	3	Vertical	285	1.46	-	43.74	29.31	5.20	35.15

LoRa (200kHz)

13/09/2019

927.4MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.78364G	27.09	54.00	-26.91	-3.09	3	Horizontal	46	1.46	-	30.18	28.15	4.10	35.34
AV	3.71199G	29.45	54.00	-24.55	-0.64	3	Horizontal	267	1.22	-	30.09	29.31	5.20	35.15
PK	2.7829G	40.20	74.00	-33.80	-3.08	3	Horizontal	46	1.46	-	43.28	28.15	4.10	35.33
PK	3.71103G	42.65	74.00	-31.35	-0.64	3	Horizontal	267	1.22	-	43.29	29.31	5.20	35.15



EMISSIONS IN RESTRICTED FREQUENCY BANDS

External Antenna

Appendix F.3

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
902-928MHz	-	-	-	-	-	-	-	-	-	-	-
LoRa (200kHz)	Pass	PK	47.46M	29.21	40.00	-10.79	3	Horizontal	360	1.00	-

Remark :

Page No. : F1 of F4

Level (dBuV/m) = Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor)

990210

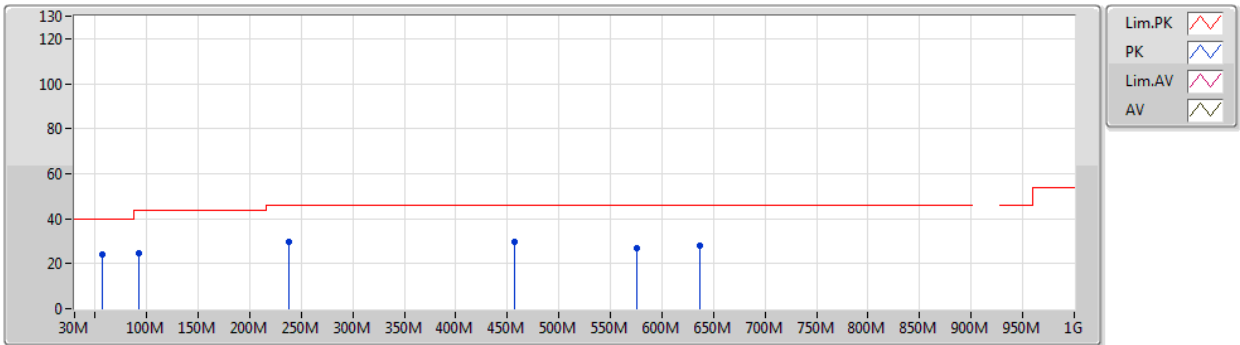
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
LoRa (200kHz)	-	-	-	-	-	-	-	-	-	-	-
915MHz_Adapter	Pass	PK	57.16M	24.07	40.00	-15.93	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	92.08M	24.62	43.50	-18.88	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	237.58M	29.52	46.00	-16.48	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	456.8M	29.76	46.00	-16.24	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	575.14M	27.10	46.00	-18.90	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	637.22M	27.99	46.00	-18.01	3	Vertical	0	1.00	-
915MHz_Adapter	Pass	PK	47.46M	29.21	40.00	-10.79	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	159.98M	24.23	43.50	-19.27	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	319.06M	26.96	46.00	-19.04	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	456.8M	29.88	46.00	-16.12	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	579.02M	26.77	46.00	-19.23	3	Horizontal	360	1.00	-
915MHz_Adapter	Pass	PK	726.46M	28.23	46.00	-17.77	3	Horizontal	360	1.00	-

LoRa (200kHz)

915MHz_Adapter

13/09/2019

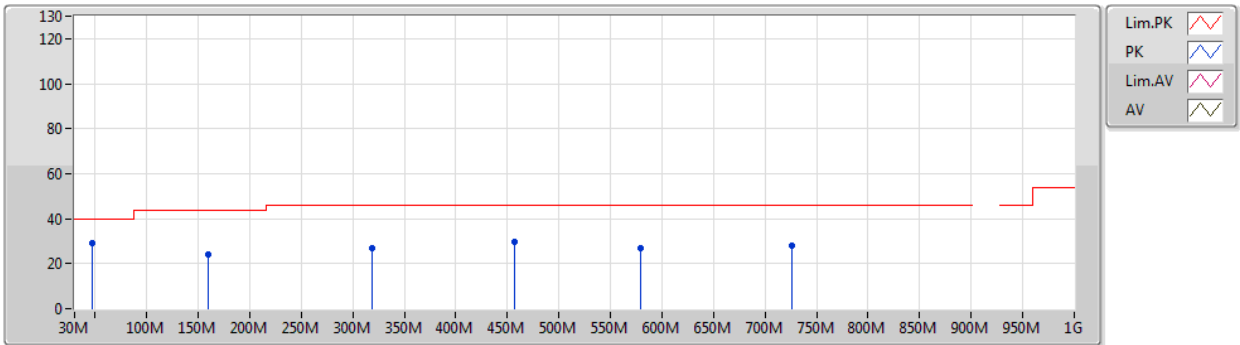


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	57.16M	24.07	40.00	-15.93	-19.04	3	Vertical	0	1.00	-	43.11	11.77	1.28	32.09
PK	92.08M	24.62	43.50	-18.88	-16.15	3	Vertical	0	1.00	-	40.77	14.47	1.49	32.11
PK	237.58M	29.52	46.00	-16.48	-13.75	3	Vertical	0	1.00	-	43.27	16.17	2.10	32.02
PK	456.8M	29.76	46.00	-16.24	-6.57	3	Vertical	0	1.00	-	36.33	22.20	2.98	31.75
PK	575.14M	27.10	46.00	-18.90	-4.49	3	Vertical	0	1.00	-	31.59	23.76	3.35	31.60
PK	637.22M	27.99	46.00	-18.01	-3.58	3	Vertical	0	1.00	-	31.57	24.27	3.65	31.50

LoRa (200kHz)

13/09/2019

915MHz_Adapter



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
PK	47.46M	29.21	40.00	-10.79	-16.37	3	Horizontal	360	1.00	-	45.58	14.47	1.25	32.09
PK	159.98M	24.23	43.50	-19.27	-15.01	3	Horizontal	360	1.00	-	39.24	15.23	1.84	32.08
PK	319.06M	26.96	46.00	-19.04	-10.83	3	Horizontal	360	1.00	-	37.79	18.65	2.45	31.93
PK	456.8M	29.88	46.00	-16.12	-6.57	3	Horizontal	360	1.00	-	36.45	22.20	2.98	31.75
PK	579.02M	26.77	46.00	-19.23	-4.52	3	Horizontal	360	1.00	-	31.29	23.70	3.36	31.58
PK	726.46M	28.23	46.00	-17.77	-3.00	3	Horizontal	360	1.00	-	31.23	24.52	3.81	31.33



EMISSIONS IN RESTRICTED FREQUENCY BANDS

External Antenna

Appendix F.4

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
902-928MHz	-	-	-	-	-	-	-	-	-	-	-
LoRa (200kHz)	Pass	AV	3.66057G	29.98	54.00	-24.02	3	Vertical	273	1.50	-

Remark :

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Level (dBuV/m) = Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamp Factor)

990210

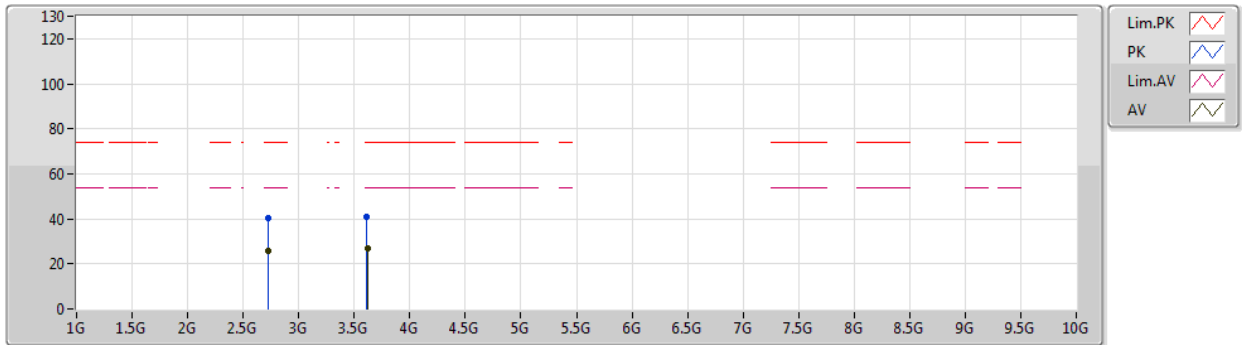
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
LoRa (200kHz)	-	-	-	-	-	-	-	-	-	-	-
902.8MHz	Pass	AV	2.72328G	25.90	54.00	-28.10	3	Vertical	317	1.50	-
902.8MHz	Pass	AV	3.62446G	26.78	54.00	-27.22	3	Vertical	31	1.49	-
902.8MHz	Pass	PK	2.72136G	40.29	74.00	-33.71	3	Vertical	317	1.50	-
902.8MHz	Pass	PK	3.61324G	40.92	74.00	-33.08	3	Vertical	31	1.49	-
902.8MHz	Pass	AV	2.72322G	25.84	54.00	-28.16	3	Horizontal	360	1.48	-
902.8MHz	Pass	AV	3.62404G	26.74	54.00	-27.26	3	Horizontal	225	2.73	-
902.8MHz	Pass	PK	2.69466G	39.69	74.00	-34.31	3	Horizontal	360	1.48	-
902.8MHz	Pass	PK	3.60148G	40.41	74.00	-33.59	3	Horizontal	225	2.73	-
915MHz	Pass	AV	2.75682G	28.19	54.00	-25.81	3	Vertical	304	1.21	-
915MHz	Pass	AV	3.66057G	29.98	54.00	-24.02	3	Vertical	273	1.50	-
915MHz	Pass	PK	2.75562G	41.27	74.00	-32.73	3	Vertical	304	1.21	-
915MHz	Pass	PK	3.6608G	42.67	74.00	-31.33	3	Vertical	273	1.50	-
915MHz	Pass	AV	2.74442G	28.18	54.00	-25.82	3	Horizontal	285	1.78	-
915MHz	Pass	AV	3.66068G	29.98	54.00	-24.02	3	Horizontal	126	2.55	-
915MHz	Pass	PK	2.74598G	40.37	74.00	-33.63	3	Horizontal	285	1.78	-
915MHz	Pass	PK	3.66006G	42.36	74.00	-31.64	3	Horizontal	126	2.55	-
927.4MHz	Pass	AV	2.78426G	27.32	54.00	-26.68	3	Vertical	360	1.50	-
927.4MHz	Pass	AV	3.71147G	29.73	54.00	-24.27	3	Vertical	360	2.06	-
927.4MHz	Pass	PK	2.78298G	40.38	74.00	-33.62	3	Vertical	360	1.50	-
927.4MHz	Pass	PK	3.7111G	42.89	74.00	-31.11	3	Vertical	360	2.06	-
927.4MHz	Pass	AV	2.78375G	27.60	54.00	-26.40	3	Horizontal	286	1.00	-
927.4MHz	Pass	AV	3.71156G	29.73	54.00	-24.27	3	Horizontal	9	1.50	-
927.4MHz	Pass	PK	2.78252G	40.33	74.00	-33.67	3	Horizontal	286	1.00	-
927.4MHz	Pass	PK	3.71098G	42.79	74.00	-31.21	3	Horizontal	9	1.50	-

LoRa (200kHz)

28/09/2019

902.8MHz_TX

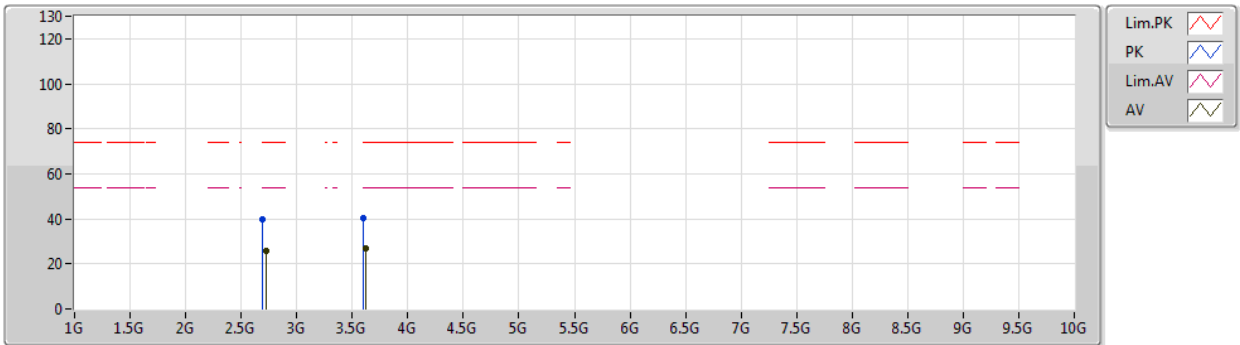


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.72328G	25.90	54.00	-28.10	-1.45	3	Vertical	317	1.50	-	27.35	28.06	5.12	34.63
AV	3.62446G	26.78	54.00	-27.22	0.34	3	Vertical	31	1.49	-	26.44	29.02	5.95	34.63
PK	2.72136G	40.29	74.00	-33.71	-1.47	3	Vertical	317	1.50	-	41.76	28.05	5.11	34.63
PK	3.61324G	40.92	74.00	-33.08	0.29	3	Vertical	31	1.49	-	40.63	29.00	5.92	34.63

LoRa (200kHz)

28/09/2019

902.8MHz_TX

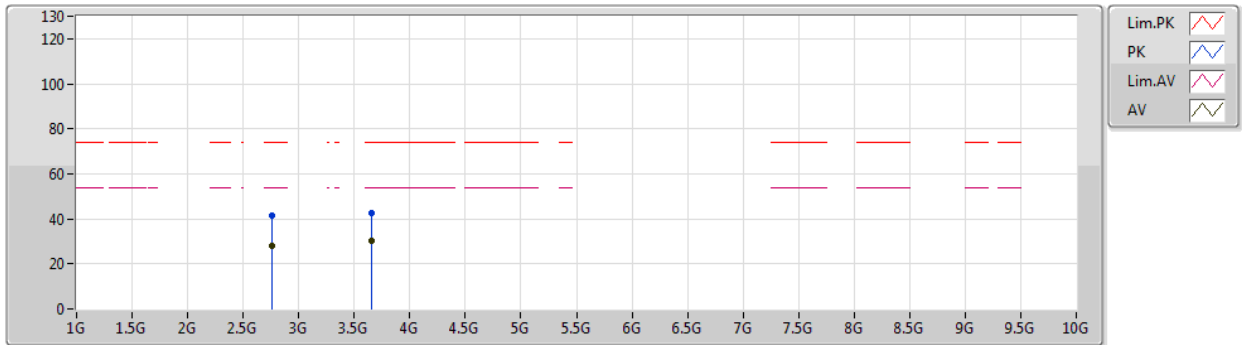


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.72322G	25.84	54.00	-28.16	-1.45	3	Horizontal	360	1.48	-	27.29	28.06	5.12	34.63
AV	3.62404G	26.74	54.00	-27.26	0.34	3	Horizontal	225	2.73	-	26.40	29.02	5.95	34.63
PK	2.69466G	39.69	74.00	-34.31	-1.53	3	Horizontal	360	1.48	-	41.22	28.01	5.08	34.62
PK	3.60148G	40.41	74.00	-33.59	0.25	3	Horizontal	225	2.73	-	40.16	28.98	5.90	34.63

LoRa (200kHz)

13/09/2019

915MHz_TX

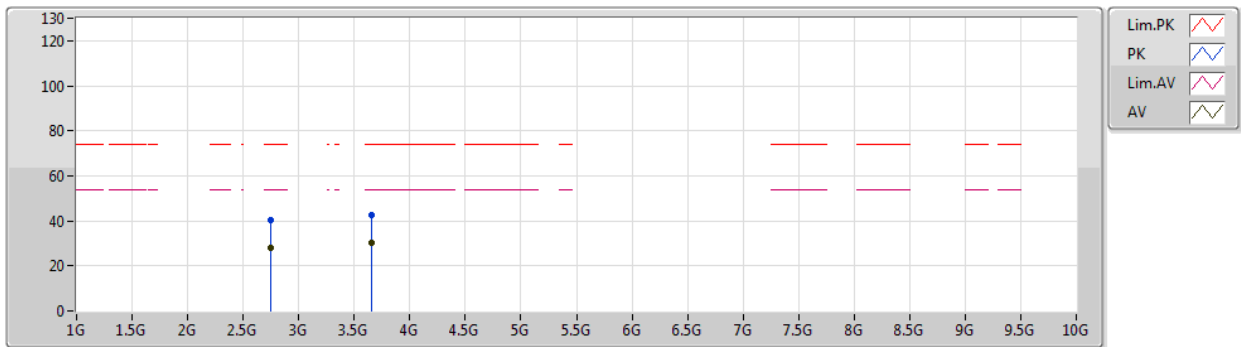


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.75682G	28.19	54.00	-25.81	-3.20	3	Vertical	304	1.21	-	31.39	28.07	4.06	35.33
AV	3.66057G	29.98	54.00	-24.02	-0.79	3	Vertical	273	1.50	-	30.77	29.22	5.15	35.16
PK	2.75562G	41.27	74.00	-32.73	-3.20	3	Vertical	304	1.21	-	44.47	28.07	4.06	35.33
PK	3.6608G	42.67	74.00	-31.33	-0.79	3	Vertical	273	1.50	-	43.46	29.22	5.15	35.16

LoRa (200kHz)

13/09/2019

915MHz_TX

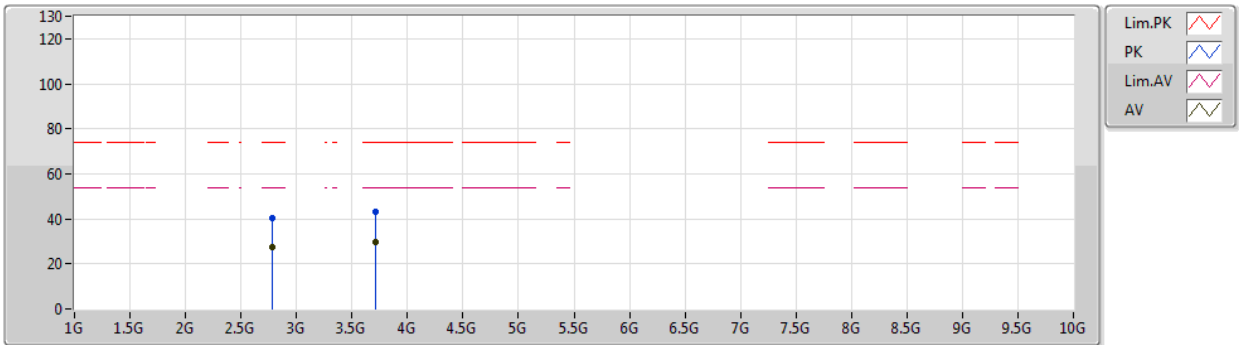


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.74442G	28.18	54.00	-25.82	-3.25	3	Horizontal	285	1.78	-	31.43	28.03	4.04	35.32
AV	3.66068G	29.98	54.00	-24.02	-0.79	3	Horizontal	126	2.55	-	30.77	29.22	5.15	35.16
PK	2.74598G	40.37	74.00	-33.63	-3.24	3	Horizontal	285	1.78	-	43.61	28.04	4.04	35.32
PK	3.66006G	42.36	74.00	-31.64	-0.79	3	Horizontal	126	2.55	-	43.15	29.22	5.15	35.16

LoRa (200kHz)

13/09/2019

927.4MHz_TX

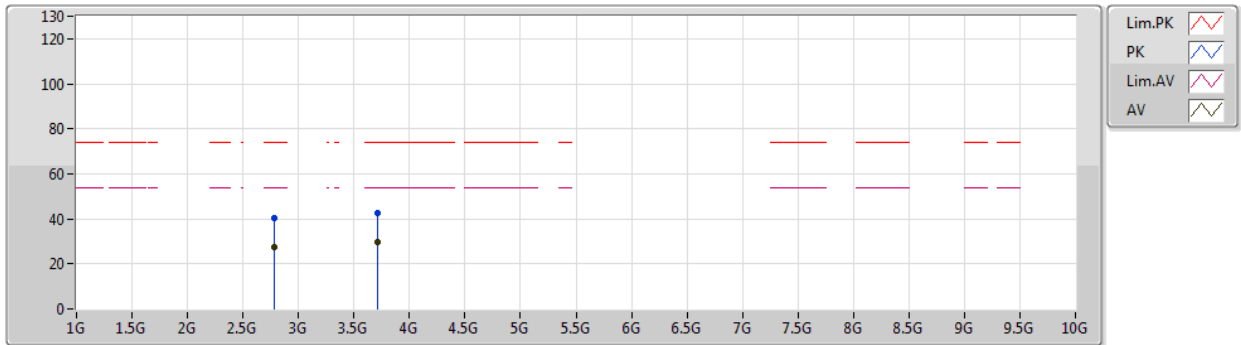


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.78426G	27.32	54.00	-26.68	-3.09	3	Vertical	360	1.50	-	30.41	28.15	4.10	35.34
AV	3.71147G	29.73	54.00	-24.27	-0.64	3	Vertical	360	2.06	-	30.37	29.31	5.20	35.15
PK	2.78298G	40.38	74.00	-33.62	-3.08	3	Vertical	360	1.50	-	43.46	28.15	4.10	35.33
PK	3.7111G	42.89	74.00	-31.11	-0.64	3	Vertical	360	2.06	-	43.53	29.31	5.20	35.15

LoRa (200kHz)

13/09/2019

927.4MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	2.78375G	27.60	54.00	-26.40	-3.09	3	Horizontal	286	1.00	-	30.69	28.15	4.10	35.34
AV	3.71156G	29.73	54.00	-24.27	-0.64	3	Horizontal	9	1.50	-	30.37	29.31	5.20	35.15
PK	2.78252G	40.33	74.00	-33.67	-3.08	3	Horizontal	286	1.00	-	43.41	28.15	4.10	35.33
PK	3.71098G	42.79	74.00	-31.21	-0.64	3	Horizontal	9	1.50	-	43.43	29.31	5.20	35.15