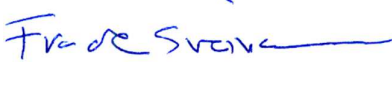


Test Report

Product	Digital Video Codec with WLAN and Bluetooth
Name and address of the applicant	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Name and address of the manufacturer	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Model	TTC6-13
Rating	Mains (100-240V 50/60 Hz)
Trademark	Cisco
Serial number	/
Additional information	Bluetooth, WLAN 2x2 802.11a/b/g/n/ac
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-247, Issue 2 Low Power Licence-Exempt Radiocommunications Devices
Order number	339941
Tested in period	2018.05.04 and 2018.06.08
Issue date	2018.06.25
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway SITE NUMBER: FCC: NO0001 IC: 2040D-1   An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frode Sveinsen]  Approved by [G.Suhanthakumar]	
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1 INFORMATION

1.1 Test Item

Name	Cisco
Model/version	TTC6-13
FCC ID	LDK06131817
Industry Canada ID	2461N-06131817
Serial number	/
Hardware identity and/or version	Rev. C
Software identity and/or version	CE 9.3.0
Frequency Range	2402 – 2480 MHz
Number of Channels	Bluetooth Low energy: 40 Bluetooth: 79
Operating Modes	Bluetooth and Bluetooth Low Energy
Type of Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK
Output Power	Basic GFSK: 7.33 mW Enhanced 8PSK: 6.71 mW BLE: 3.36 mW
Antenna Connector	External Antenna with RP-SMA connector
Number of antennas	1
Antenna Diversity Supported	No
Power Supply	Mains powered (integral power supply)

Description of Test Item

The EUT is a digital video codec with WiFi and Bluetooth transceivers. The WiFi and Bluetooth transceivers are contained in a module from NVIDIA with single modular certification (FCC ID: VOB-P3310), however the antennas used in this EUT are not certified.

1.2 Normal test conditions

Temperature:	20 – 25 °C
Relative humidity:	20 - 50 %
Normal test voltage:	120V 60Hz

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

Thomas Dangelé (Power Line Conducted Test)

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rationale

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☒ Yes ☐ No

If detachable, is the antenna connector non-standard?

☒ Yes ☐ No

Type of antenna connector: RP-SMA

Ref. FCC §15.203

1.7 Antenna Gain

One of the two whip antennas at the back of the codecware used for Bluetooth. The values below are the antenna gain values provided by the manufacturer:

Frequency (MHz)	Max Antenna Gain (dBi)
2400	4.37
2410	4.30
2420	4.31
2440	4.25
2450	4.40
2460	4.41
2470	4.50
2480	4.58

1.8 Comments

This report covers only limited radiated tests to show compliance with the new antenna in this EUT. All other radio tests for DSS are covered by UL reports no. 11526345-E1V2.

Radio tests for BLE are covered by UL report no. 11526345-E2V2. Output Power when operating in BLE mode is lower than in normal BT mode, therefore spurious emissions are only measured in BT mode.

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISSED RSS-247 Issue 2.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

A description of the test facility is on file with the FCC and Industry Canada.

☒ New Submission

☐ Class II Permissive Change

DSS Equipment Code*

☒ Production Unit

☐ Pre-production Unit

☐ Family Listing

*Equipment Code for BLE mode is DTS



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 1, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	N/A	Complies ¹
Number of Operating Frequencies	15.31(m)	5.1 (6) (RSS-247)	Complies ¹
Antenna Requirement	15.203	6.8 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Channel Separation	15.247(a)(1)	5.1 (4) (RSS-247)	Complies ¹
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	Complies ¹
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	Complies ¹
Occupied Bandwidth	N/A	6.7 (RSS-GEN)	Complies ¹
20dB Bandwidth	15.247(a)(1)	5.1 (RSS-247)	Complies ¹
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies ¹
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	Complies ¹
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ Covered by UL Report No. 11526345-E1V2 (FCC ID: VOB-P3310)

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207 (a)

ISED RSS-GEN Issue 5, Clause 8.8

Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN.

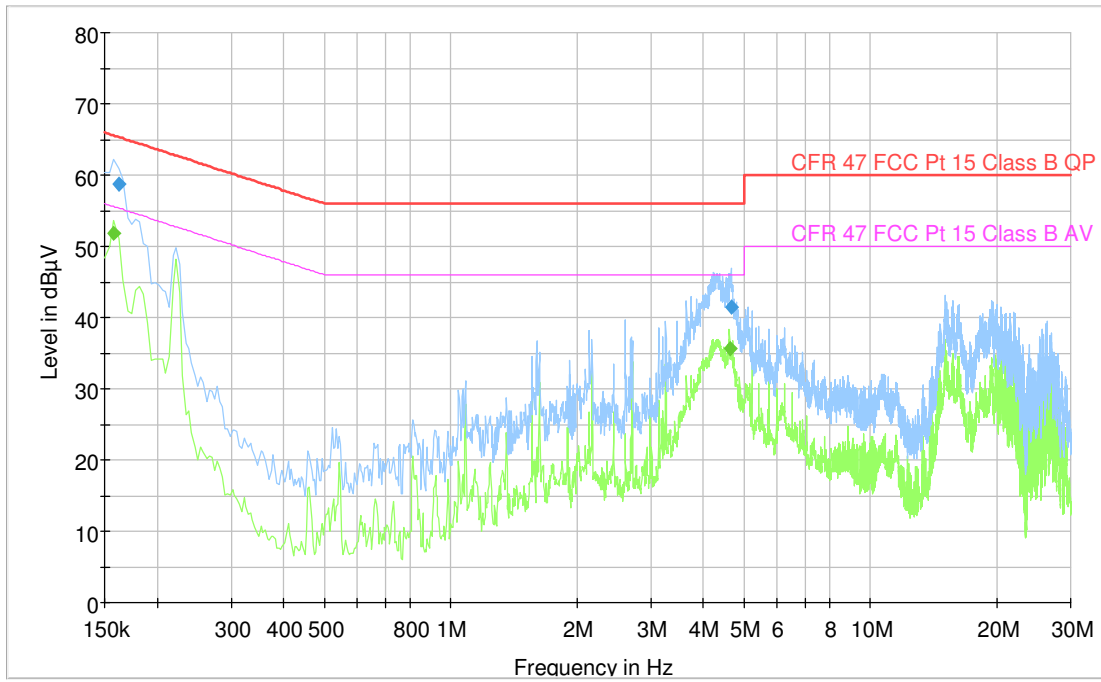
Test Results: Complies.

Measurement Data: See attached graph, (Peak detector).

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.158	---	51.85	55.57	3.72	1000	9	L1	OFF	9.7
0.162	58.73	---	65.36	6.63	1000	9	L1	OFF	9.7
4.624	---	35.60	46.00	10.40	1000	9	L1	OFF	9.7
4.652	41.37	---	56.00	14.63	1000	9	L1	OFF	9.7

Full Spectrum



120V 60Hz

3.2 Radiated Emissions, Restricted Band Edges

FCC 15.205, 15.209

ISED RSS-GEN Issue 5, Clause 8.9

Test Results: Complies

Measurement Data:

Detector: Peak
Measuring distance: 3m
EUT Height: 1.5m, ground plane covered by absorbers
Tested with all all connections active

	Measured field strength (dBμV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dBμV/m	dB	
Peak Detector	42.3	60.0	74	31.7	14.0
Average Detector	22.3	40.0	54	31.7	14.0

Average Detector values are measured with Peak Detector and corrected for Duty Cycle.

Values for QPSK and 8PSK were the same at Upper Band Edge.

The modulation scheme did not affect the result at Lower Band Edge.

See attached plots.

Duty Cycle Correction Factor Calculation:

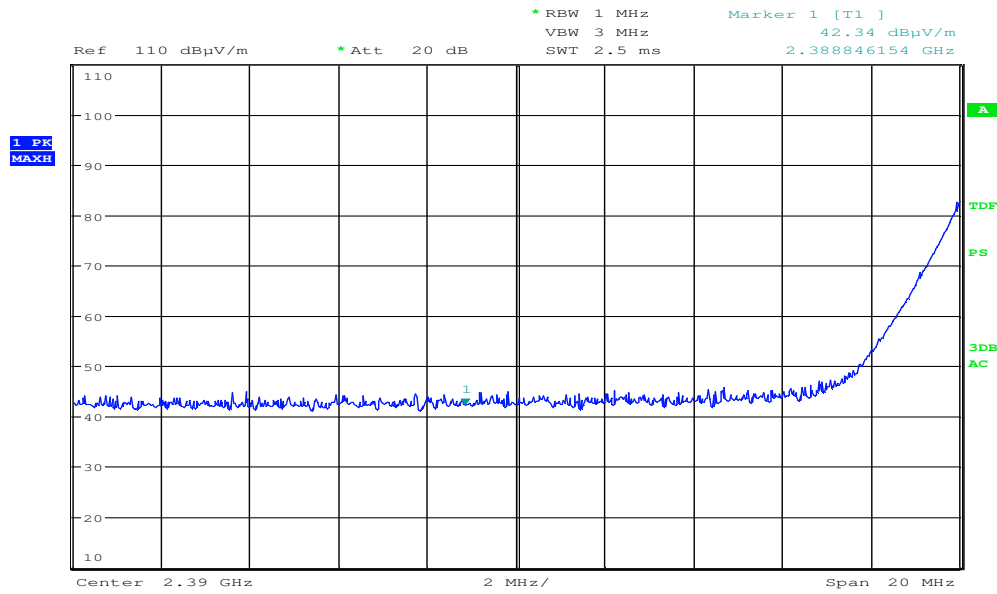
Calculated from values in UL report no. 11526345-E1V2.

Mode	On Time (ms)	Period (ms)	Duty Cycle (linear)	Number of Hopping Channels	Calculated Duty Cycle Correction Factor (dB)	Duty Cycle Correction Factor (dB)
GFSK	2.870	3.757	0.764	79	40.2	20
8PSK	1.062	3.745	0.284	79	49.1	20

Duty Cycle Correction factor = $-20 \times \log(\text{Duty Cycle}/\text{Number of Hopping Channels})$

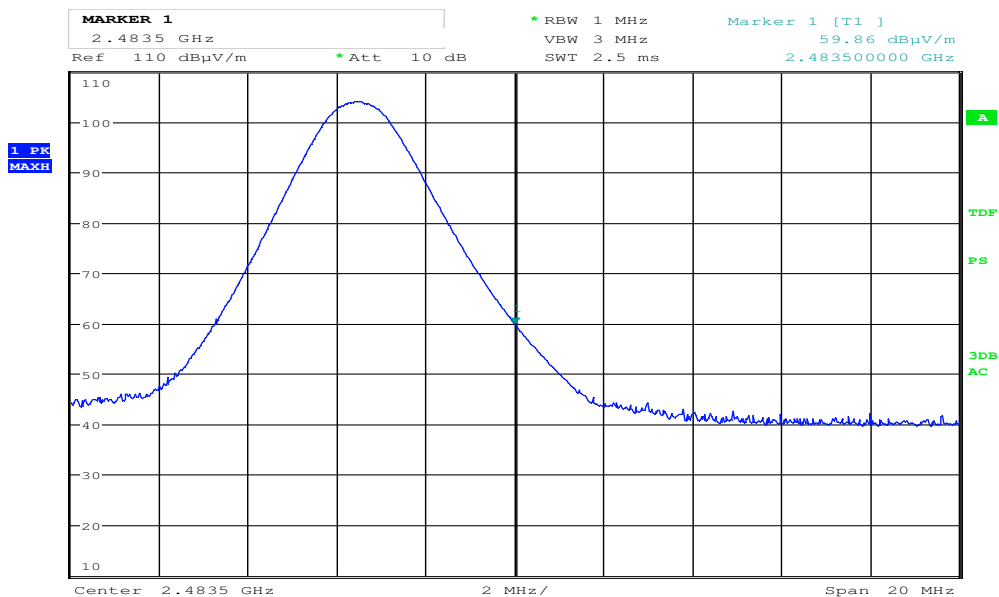
Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

Correction Factors above are used with field strength values and are valid when EUT is operating in hopping mode with 79 hopping channels.



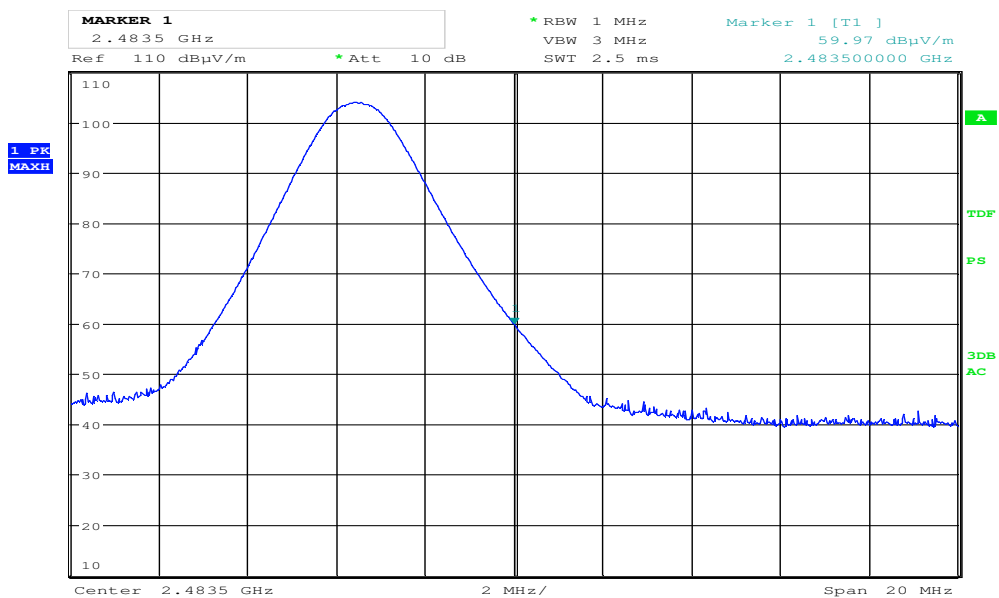
Date: 4.MAY.2018 16:08:49

Lower Band Edge, 2402MHz, Peak, (Max: VP)



Date: 4.MAY.2018 16:27:08

Upper Band Edge, 2480MHz, GFSK, Peak, (Max: VP)



Date: 4.MAY.2018 16:13:39

Upper Band Edge, 2480MHz, 8PSK, Peak, (Max: VP)

3.3 Radiated Emissions, 30 – 1000 MHz

FCC 15.205, 15.209

ISED RSS-GEN Issue 5, Clause 8.9

Test Results: Complies

Measurement Data:

Detector: Quasi-Peak

Measuring distance: 3m

EUT Height: 0.8m at 1GHz and below, Conducting ground plane

Tested with all all connections active

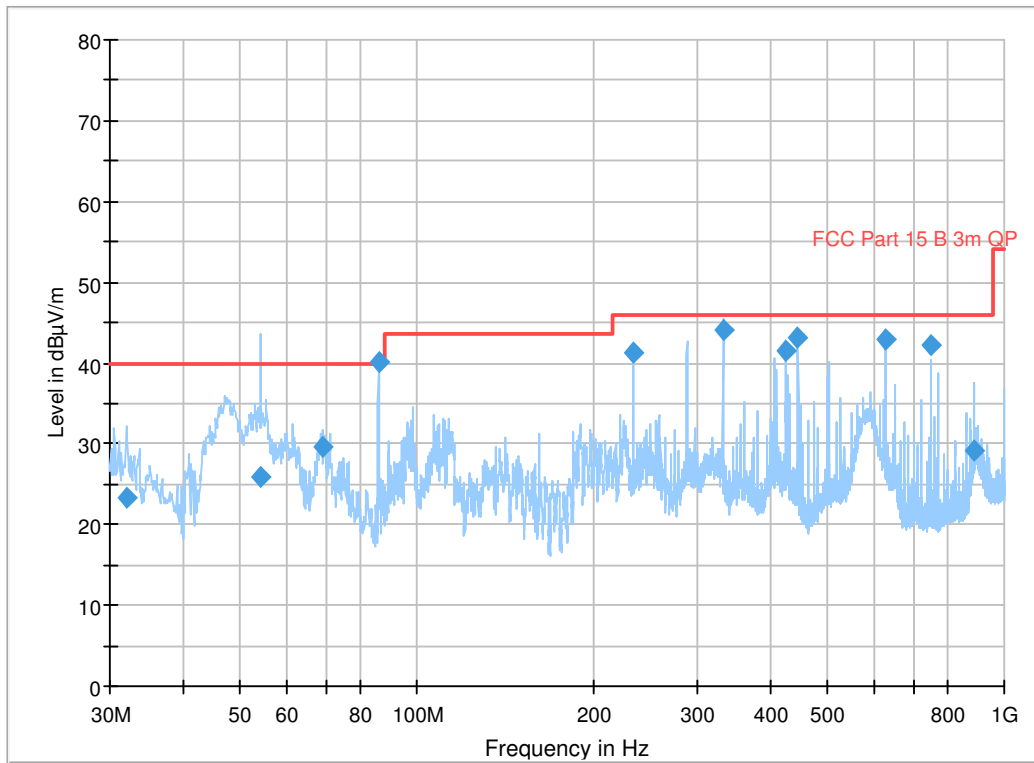
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.103550	23.27	40.00	16.73	1000.0	120.000	99.0	V	45.0	-12.3
53.988250	25.87	40.00	14.13	1000.0	120.000	101.0	V	175.0	-22.6
69.108750	29.59	40.00	10.41	1000.0	120.000	300.0	V	210.0	-24.1
86.015650	40.15	40.00	-0.15	1000.0	120.000	162.0	V	121.0	-23.0
233.470950	41.25	46.00	4.75	1000.0	120.000	151.0	H	102.0	-19.1
331.773950	44.16	46.00	1.84	1000.0	120.000	99.0	H	236.0	-16.1
425.000300	41.58	46.00	4.42	1000.0	120.000	106.0	V	110.0	-13.6
445.497550	43.21	46.00	2.79	1000.0	120.000	123.0	V	129.0	-13.1
626.684500	42.89	46.00	3.11	1000.0	120.000	173.0	V	166.0	-10.3
749.563750	42.24	46.00	3.76	1000.0	120.000	124.0	H	160.0	-7.9
890.994950	29.05	46.00	16.95	1000.0	120.000	205.0	V	83.0	-5.7

See attached plot

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (µV/m)	Quasi Peak (dBµV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

Full Spectrum



Radiated Emissions, 30 -1000MHz

3.4 Radiated Emissions, 1-25 GHz

FCC 15.205, 15.209

ISED RSS-GEN Issue 5, Clause 8.9

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)
1m (18 – 26 GHz)

EUT Height: 1.5m for all frequencies above 1 GHz

Radiated Emissions in Restricted Bands						
Carrier Modulation	Carrier Freq MHz	Measured Freq MHz	Measured value Peak dBμV/m @3m	Calculated value AV dBμV/m @3m	Limit (dBμV/m)	Verdict
GFSK	Any	1633.5	48.7	< 54	74/54	Complies
GFSK	Any	2079	48.1	< 54	74/54	Complies
GFSK	Any	1930	47.6	37.4	74/54	Complies

* Not an emission from the radio

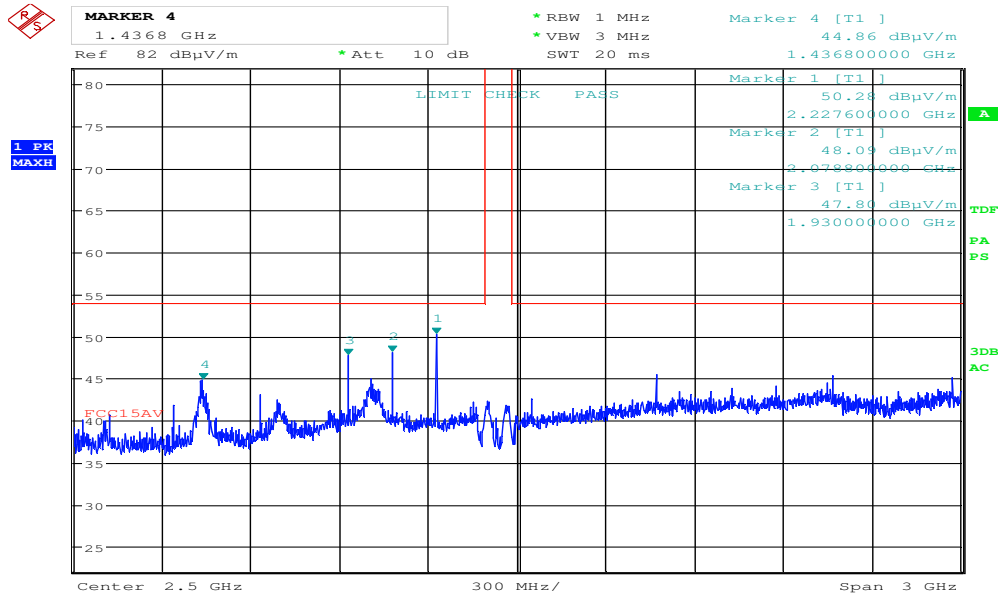
Only harmonics that fall in the restricted bands (ref. §15.205) have been checked.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

See attached plots.

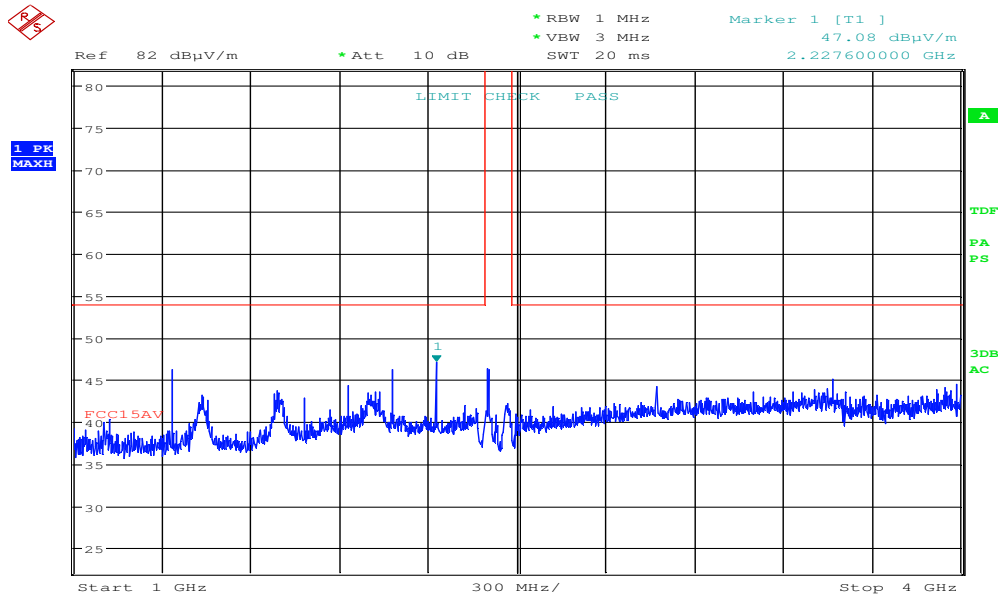
Limits

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	AV (dBμV/m)	Peak (dBμV/m)
Above 1 GHz	54.0	74.0



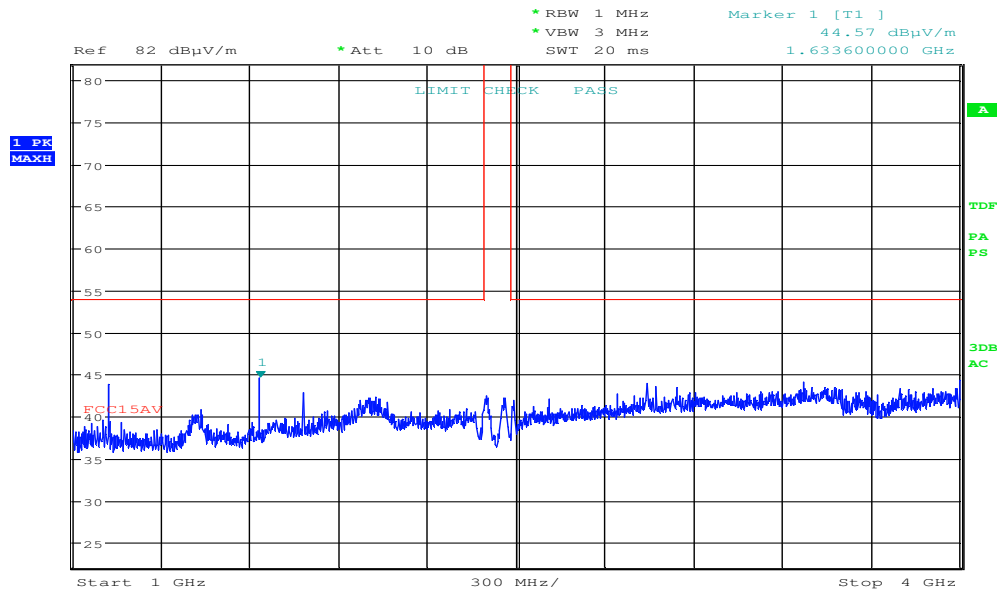
Date: 15.MAY.2018 18:46:54

Radiated Emissions, 1000 -4000 MHz, 2402 MHz, GFSK, HP



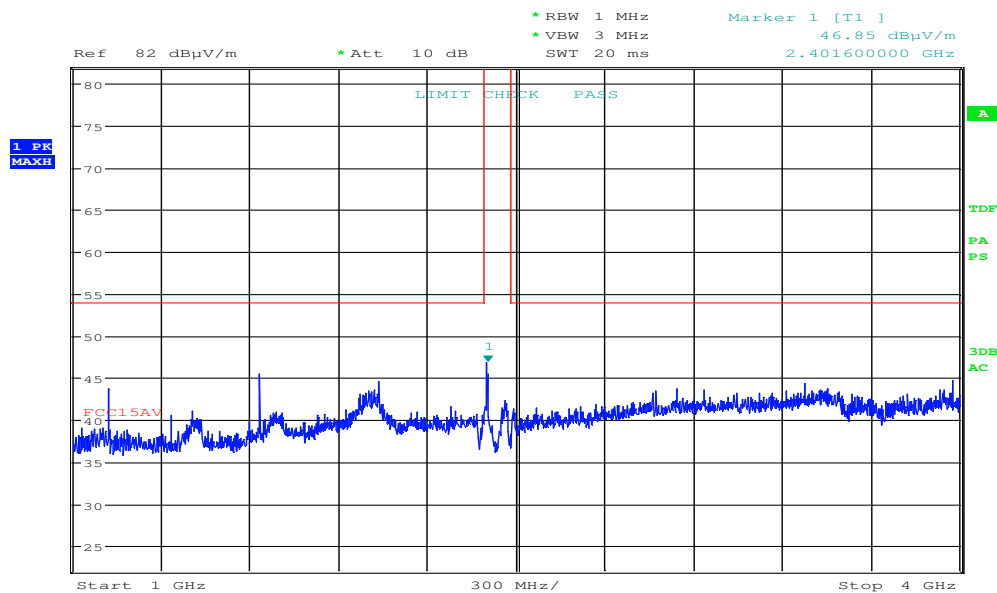
Date: 15.MAY.2018 18:42:18

Radiated Emissions, 1000 -4000 MHz, 2402 MHz, GFSK, VP



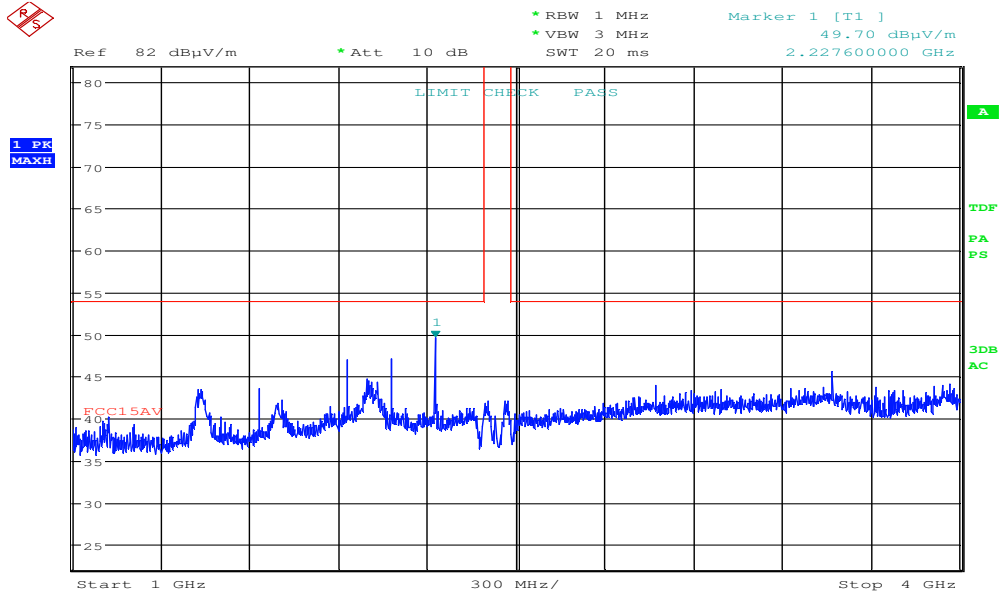
Date: 4.MAY.2018 16:43:38

Radiated Emissions, 1000 -4000 MHz, 2402 MHz, 8PSK, HP



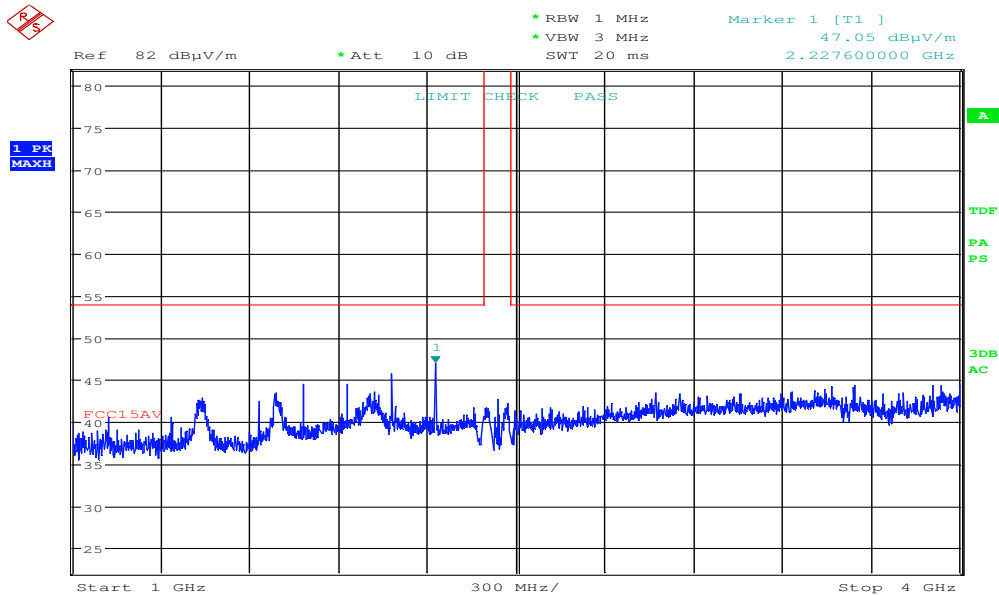
Date: 4.MAY.2018 16:41:33

Radiated Emissions, 1000 -4000 MHz, 2402 MHz, 8PSK, VP



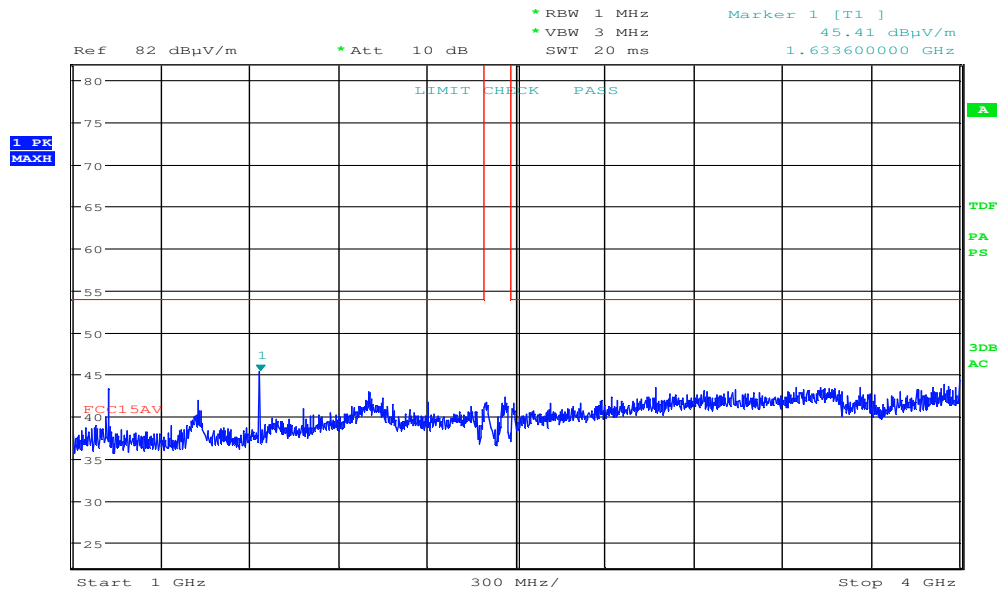
Date: 15.MAY.2018 19:21:37

Radiated Emissions, 1000 -4000 MHz, 2440 MHz, GFSK, HP



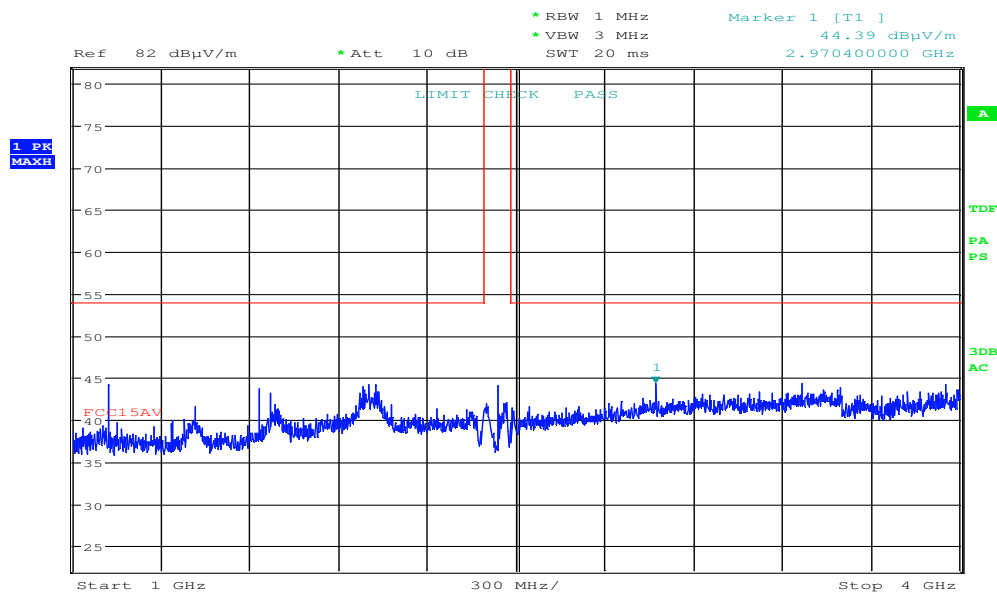
Date: 15.MAY.2018 19:19:32

Radiated Emissions, 1000 -4000 MHz, 2440 MHz, GFSK, VP



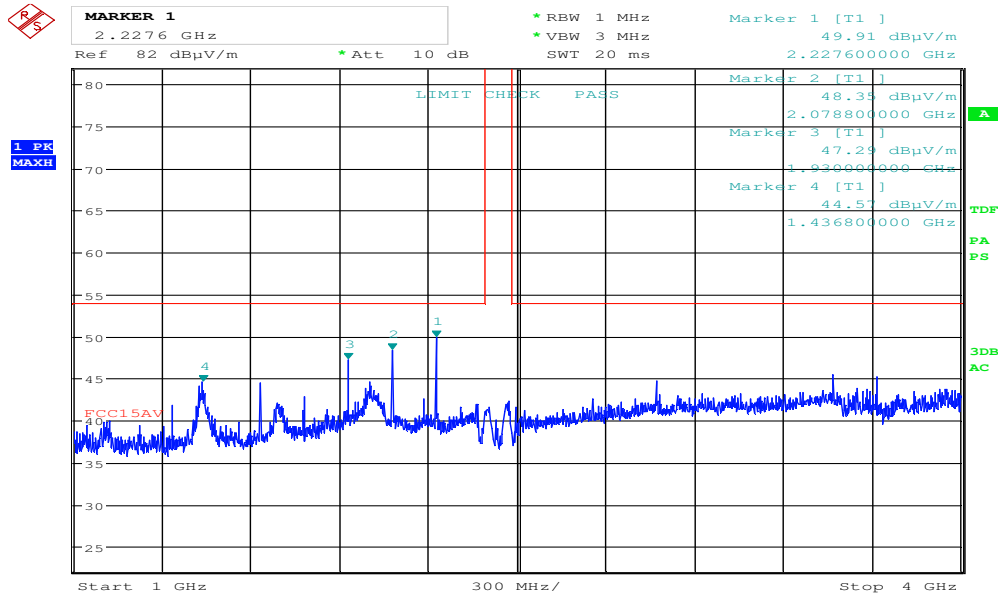
Date: 4.MAY.2018 16:49:18

Radiated Emissions, 1000 -4000 MHz, 2440 MHz, 8PSK, HP



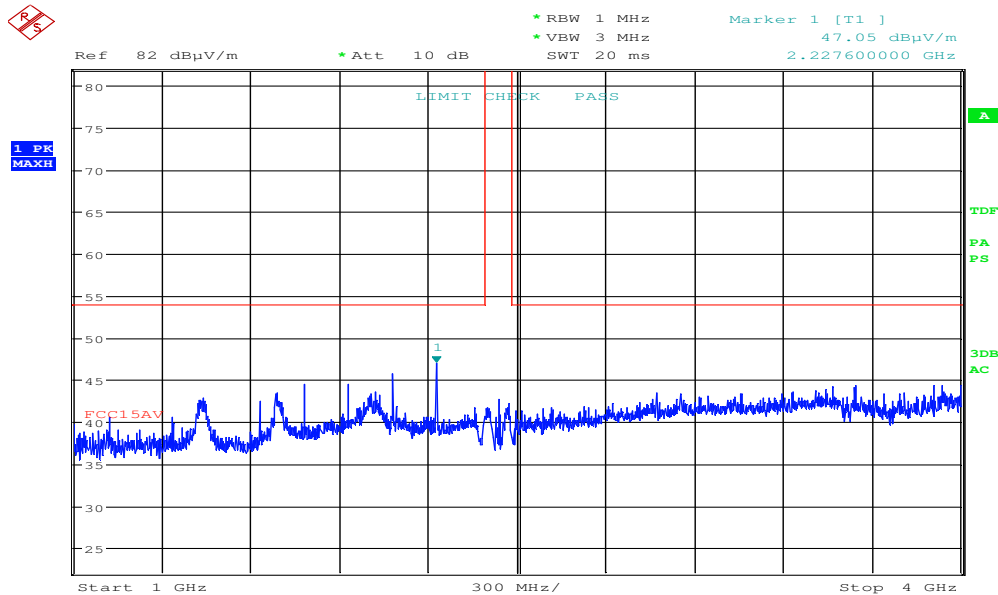
Date: 4.MAY.2018 16:47:13

Radiated Emissions, 1000 -4000 MHz, 2440 MHz, 8PSK, VP



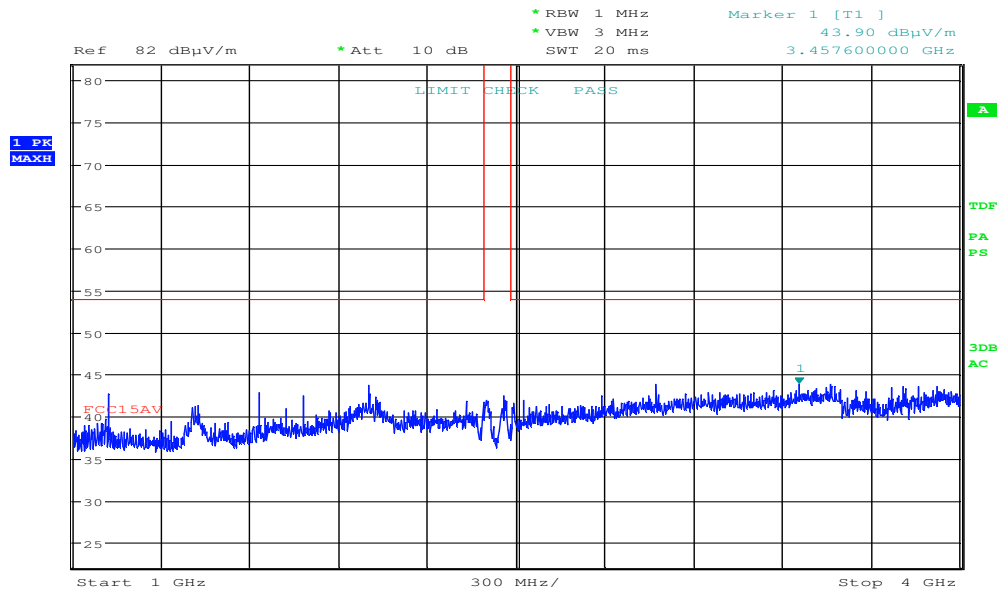
Date: 15.MAY.2018 19:15:17

Radiated Emissions, 1000 -4000 MHz, 2480 MHz, GFSK, HP



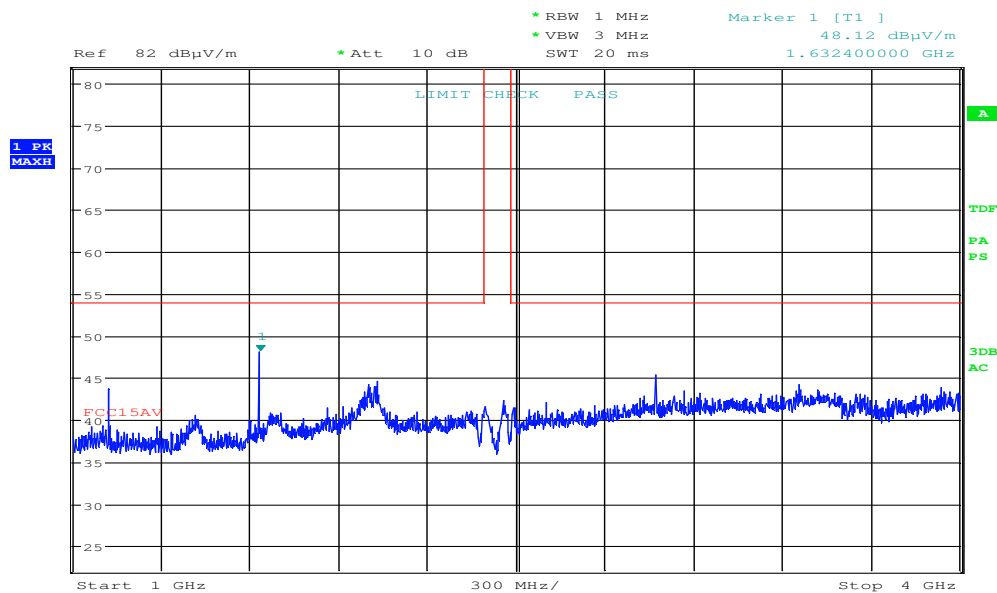
Date: 15.MAY.2018 19:19:32

Radiated Emissions, 1000 -4000 MHz, 2480 MHz, GFSK, VP



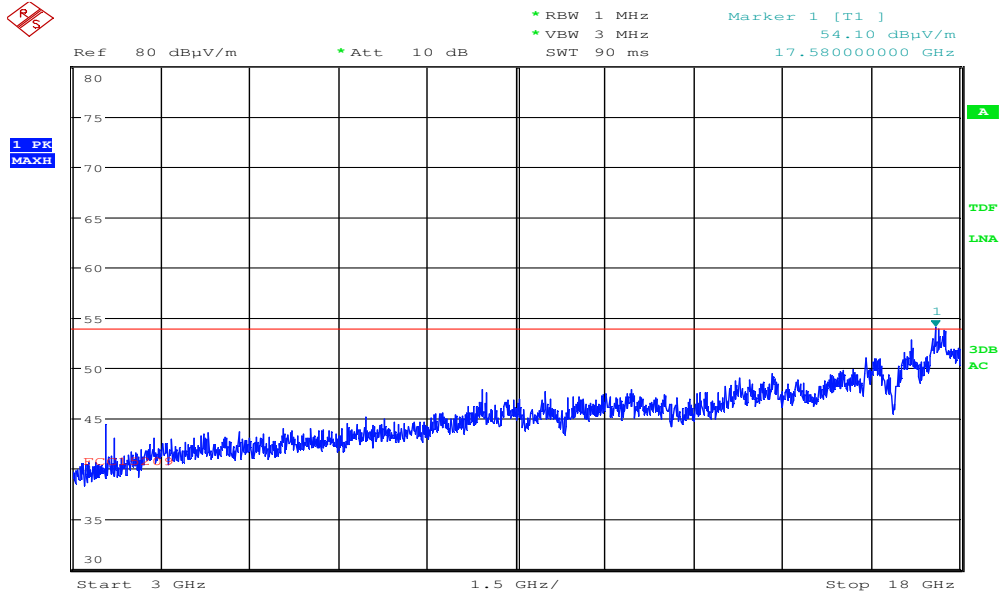
Date: 4.MAY.2018 16:54:10

Radiated Emissions, 1000 -4000 MHz, 2480 MHz, 8PSK, HP



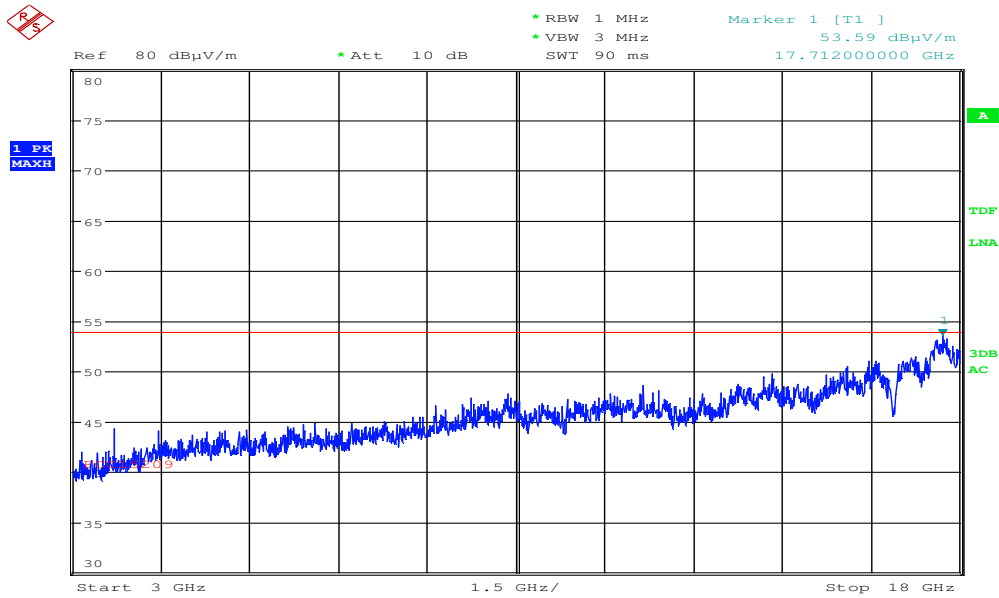
Date: 4.MAY.2018 16:52:05

Radiated Emissions, 1000 -4000 MHz, 2480 MHz, 8PSK, VP



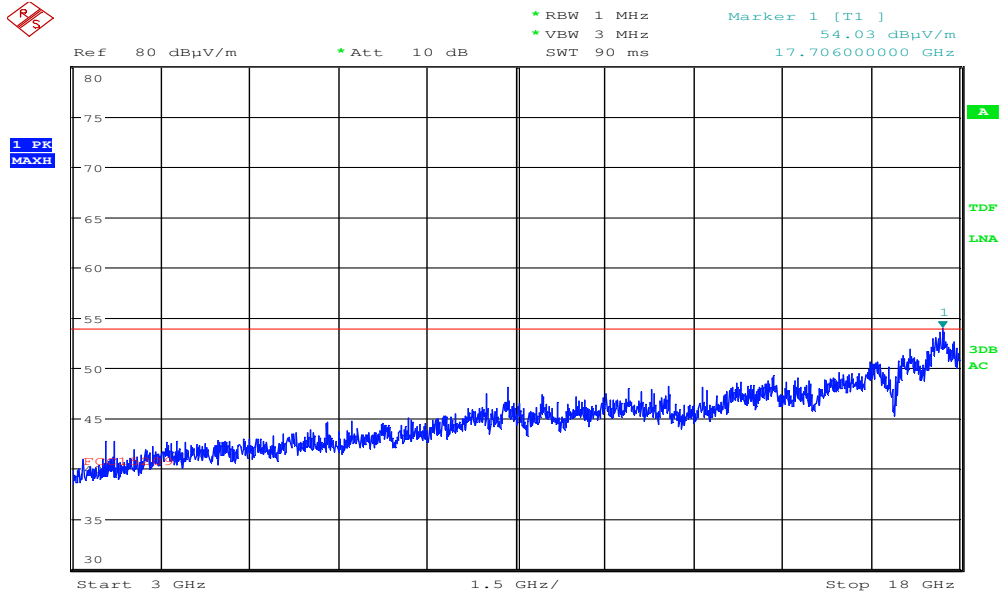
Date: 24.MAY.2018 10:31:57

Radiated Emissions, 3000 -18000 MHz, 2402 MHz, GFSK, HP



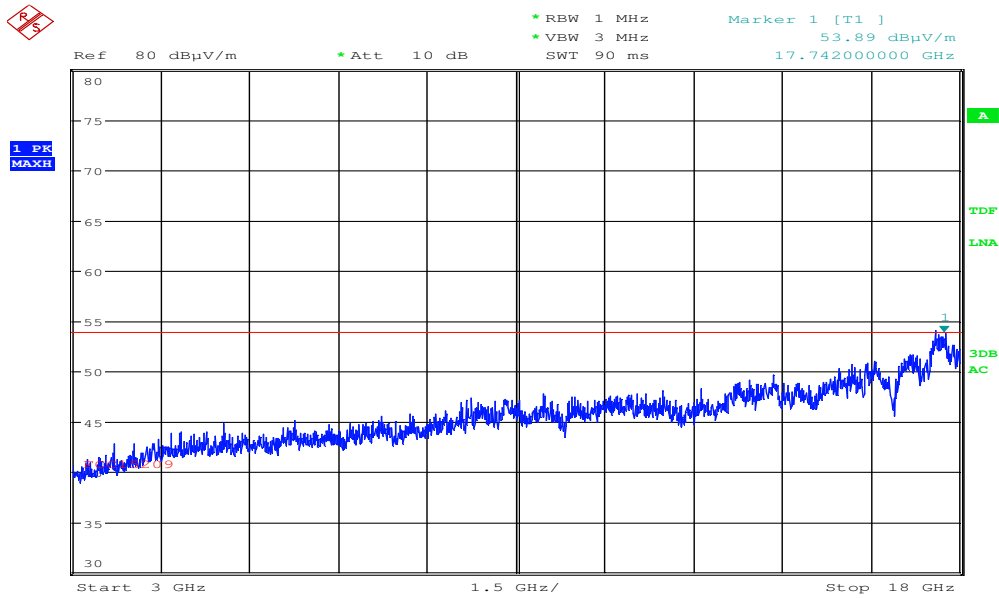
Date: 24.MAY.2018 10:14:00

Radiated Emissions, 3000 -18000 MHz, 2402 MHz, GFSK, VP



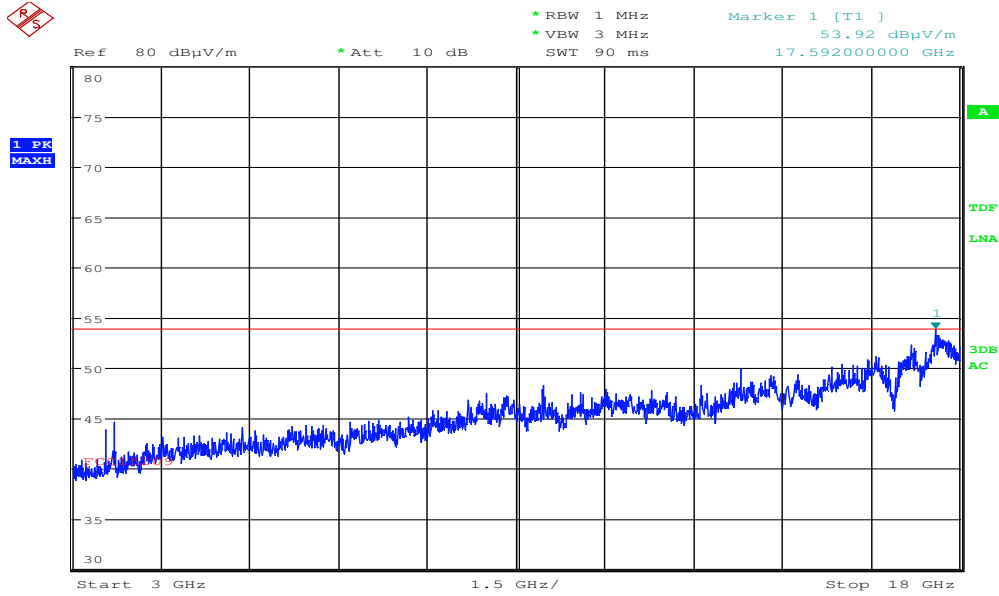
Date: 24.MAY.2018 10:28:25

Radiated Emissions, 3000 -18000 MHz, 2440 MHz, GFSK, HP



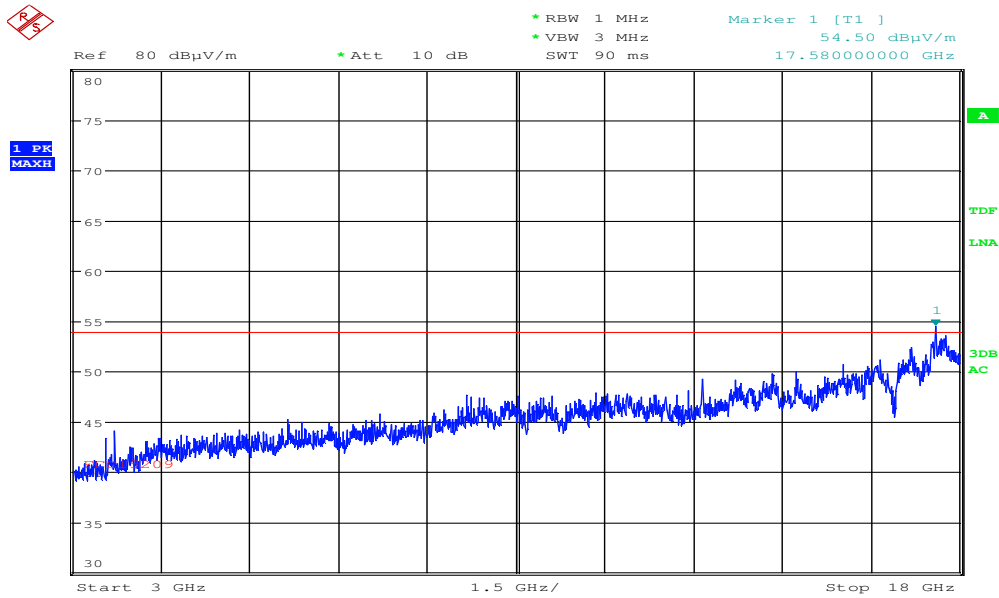
Date: 24.MAY.2018 10:23:14

Radiated Emissions, 3000 -18000 MHz, 2440 MHz, GFSK, VP



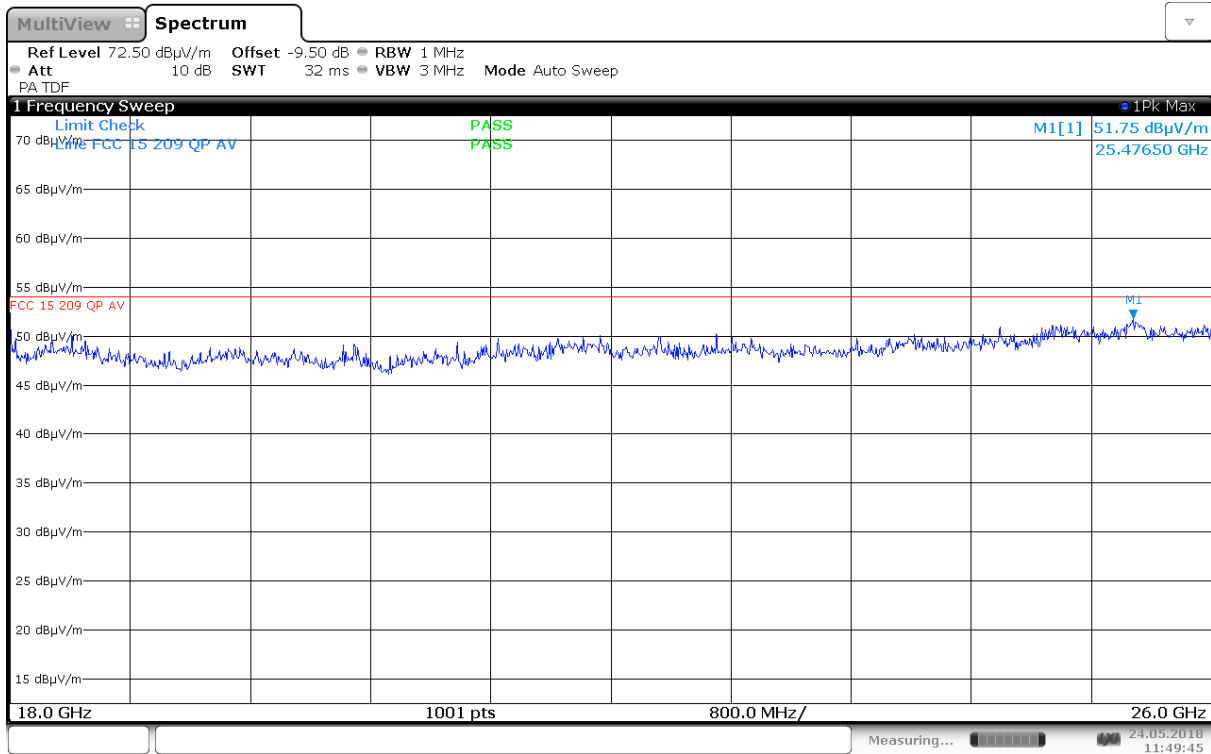
Date: 24.MAY.2018 10:34:31

Radiated Emissions, 3000 -18000 MHz, 2480 MHz, GFSK, HP

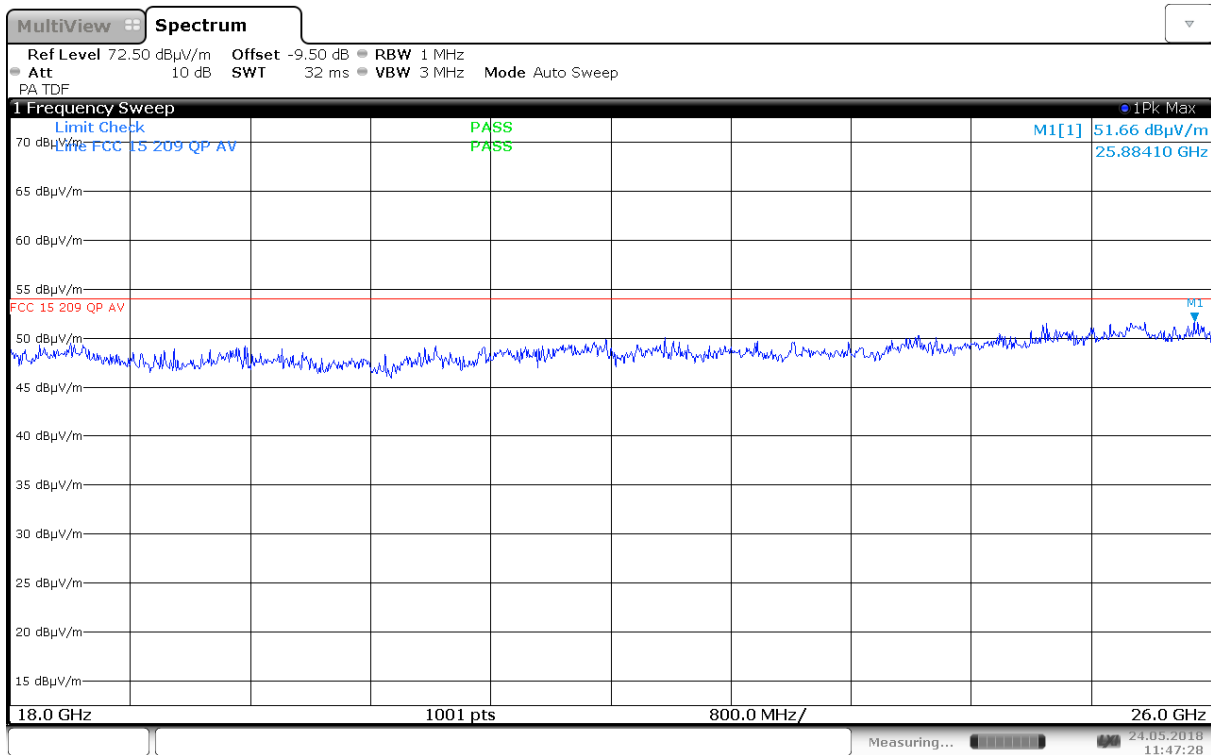


Date: 24.MAY.2018 10:18:28

Radiated Emissions, 3000 -18000 MHz, 2480 MHz, GFSK, VP



Radiated Emissions, 18000 -26000MHz, 2440MHz, GFSK, HP, @1m



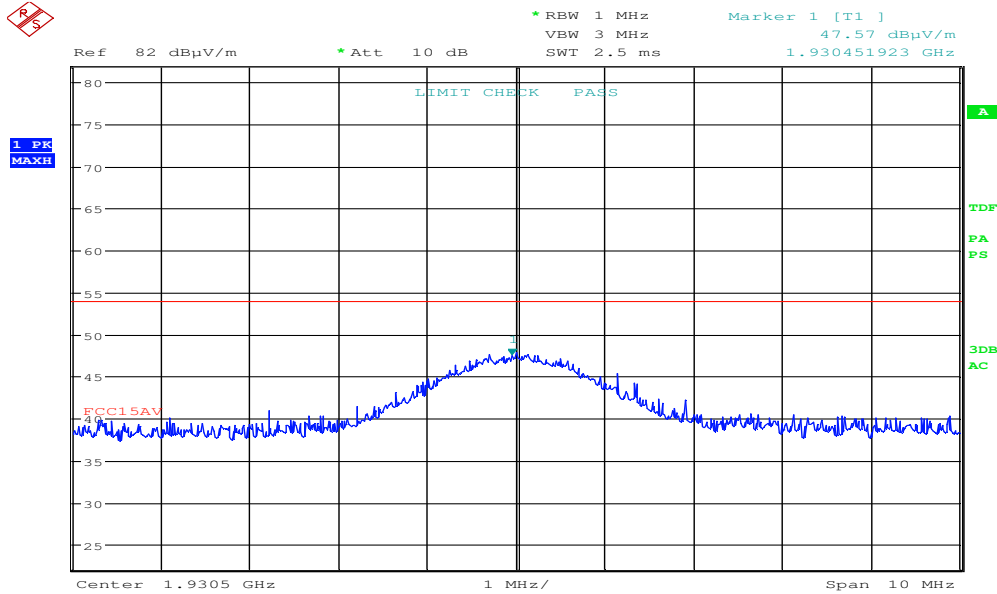
Radiated Emissions, 18000 -26000MHz, 2440MHz, GFSK, VP, @1m



(value is the same for all carriers and modulations)



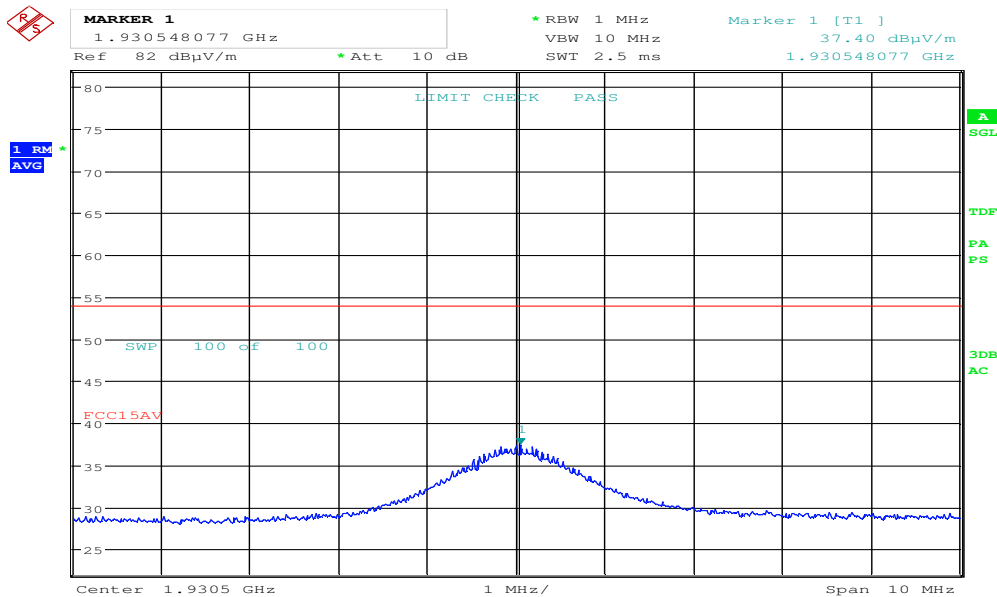
(value is the same for all carriers and modulations)



Date: 15.MAY.2018 19:00:35

Radiated Emissions, 1930 MHz Peak (Max: VP)

(value is the same for all carriers and modulations)



Date: 15.MAY.2018 19:01:32

Radiated Emissions, 1930 MHz RMS (Max: VP)

(value is the same for all carriers and modulations)

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

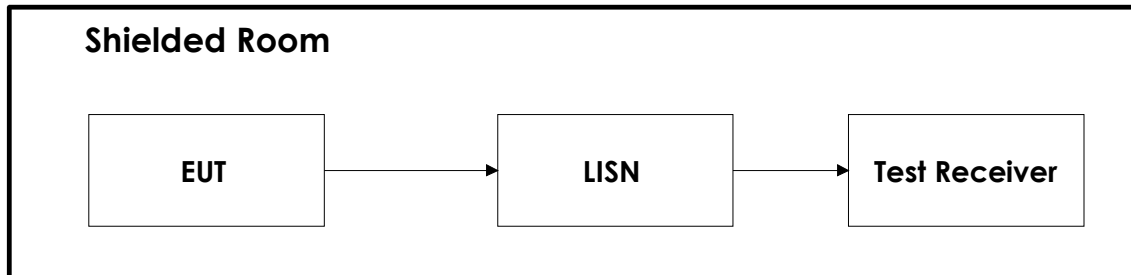
No.	Model	Description	Manufacturer	Asset no.	Cal. date	Cal. Due
1	FSW40	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2018.01	2019.01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2018.03	2019.03
3	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	COU	
	310	Preamplifier	Sonoma Instrument	LR 1686	2017.08	2018.08
4	317	Preamplifier	Sonoma Instrument	LR 1687	2017.08	2018.08
5	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2017.08	2018.08
6	6812B	AC Power Source	Agilent	LR 1515	COU	
7	3115	Horn Antenna	EMCO	LR 1330	2016.10	2021.10
8	3117-PA	Horn Antenna with Preamp	EMCO	LR 1717	2017.12	2018.12
9	JB3	BiLog Antenna	Sunol	N-4525	2017.11	2020.11
10	638	Antenna Horn	Narda	LR 1480	2010.06	2020.06
11	ESC13	Measuring receiver	Rohde & Schwarz	N-4259	2017.10	2018.10
12	ENV216	Two-Line V-Network	Rohde & Schwarz	LR 1665	2017.11	2019.11
13	Model 87 V	Multimeter	Fluke	N-4669	2016.10	2018.10

COU = Calibrate on use

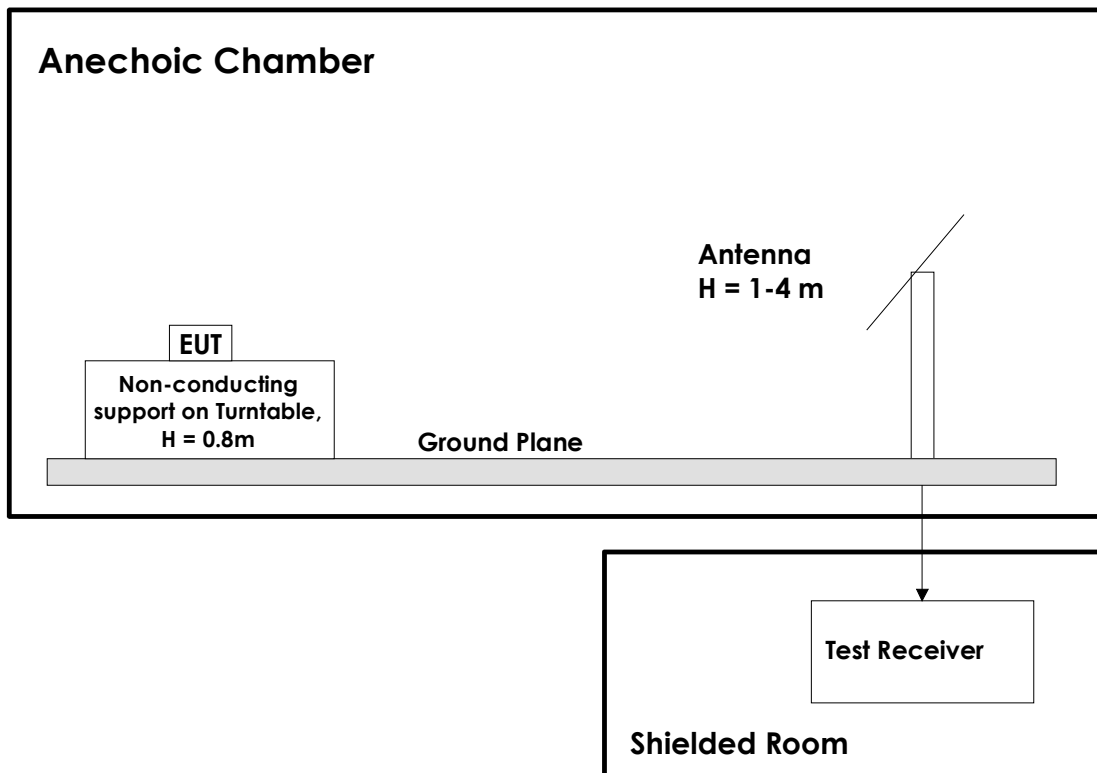
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	10.20.01
EMC Software for Radiated tests	Rohde & Schwarz	EMC32	10.20.01

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



All tests below 1 GHz were performed at 3m with ground plane. The EUT was placed on the stand at 0.8m height.

Tests above 1 GHz were performed with the space between the EUT and the antenna covered by absorbers. The EUT was placed on a 1.5m high stand. Tests from 1 GHz to 18 GHz were performed @3m distance. Tests above 18 GHz were performed @1m distance.

The antenna was raised from 1 to 4m and the turntable rotated from 0 to 360 degrees to maximize any emissions found.

Revision history

Version	Date	Comment	Sign
1.0	2018.06.11	First edition	FS
1.1	2018.06.21	Corrections to test setup description	FS
1.2	2018.06.25	Added antenna gain values	FS