

Prüfbericht-Nr.: Test report no.:	CN226I9Q 001	Auftrags-Nr.: Order no.:	244359037	Seite 1 von 18 Page 1 of 18
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2021-09-06	
Auftraggeber: Client:	Whetron Electronics (Suzhou) Co., Ltd. No. 457 Xiangjiang Road, High New District, Suzhou, Jiangsu, 215129, P.R. China			
Prüfgegenstand: Test item:	TPMS Sensor			
Bezeichnung / Typ-Nr.: Identification / Type no.:	2D000689 FCC ID: 2ALBSS200235500S1 IC:27971-2D000689			
Auftrags-Inhalt: Order content:	Complete test			
Prüfgrundlage: Test specification:	FCC CFR47 Part 15, Subpart C Section 15.231 RSS-210 Issue 10, December 2019 RSS-Gen Issue 5, Amendment 2, February 2021 ANSI C63.10: 2013			
Wareneingangsdatum: Date of sample receipt:	2021-11-26			
Prüfmuster-Nr.: Test sample no.:	A003172460-001			
Prüfzeitraum: Testing period:	Refer to test report			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	genehmigt von: authorized by:			
Datum: Date:	Ausstellungsdatum: Issue date:			
Stellung / Position:	Stellung / Position:			
Sonstiges / HVIN: 2D000689 Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht - Nr.: CN226I9Q 001
Test Report No.

Seite 2 von 18
Page 2 of 18

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 20dB & 99% BANDWIDTH

RESULT: Pass

5.1.3 TRANSMISSION TIME / SILENT PERIOD

RESULT: Pass

5.1.4 CONDUCTED EMISSION

RESULT: N/A

5.1.5 FIELD STRENGTH OF FUNDAMENTAL AND RADIATED SPURIOUS EMISSION

RESULT: Pass

Contents

1.	GENERAL REMARKS	4
1.1	COMPLEMENTARY MATERIALS.....	4
2.	TEST SITES	4
2.1	TEST FACILITIES	4
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	5
2.3	TRACEABILITY	5
2.4	CALIBRATION	5
2.5	MEASUREMENT UNCERTAINTY	5
3.	GENERAL PRODUCT INFORMATION.....	6
3.1	PRODUCT FUNCTION AND INTENDED USE	6
3.2	RATINGS AND SYSTEM DETAILS.....	6
3.3	INDEPENDENT OPERATION MODES.....	6
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	7
3.5	SUBMITTED DOCUMENTS.....	7
4.	TEST SET-UP AND OPERATION MODES.....	8
4.1	PRINCIPLE OF CONFIGURATION SELECTION	8
4.2	TEST OPERATION AND TEST SOFTWARE.....	8
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	8
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	8
5.	TEST RESULTS	9
5.1	CONDUCTED TESTING AT ANTENNA PORT	9
5.1.1	<i>Antenna Requirement</i>	<i>9</i>
5.1.2	<i>20dB & 99% Bandwidth</i>	<i>11</i>
5.1.3	<i>Transmission Time / Silent Period</i>	<i>12</i>
5.1.4	<i>Conducted Emission</i>	<i>13</i>
5.1.5	<i>Field strength of fundamental and Radiated Spurious Emission</i>	<i>14</i>
6.	LIST OF TABLES	18
7.	LIST OF FIGURES	18

1. General Remarks

1.1 Complementary Materials

Null.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland (Shanghai) Co., Ltd.
Shanghai TÜV Rheinland Building No. 177, 178 Lane 777, West Guangzhong Rd, Jing'an District, Shanghai, China

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 958801.

The Innovation, Science and Economic Development Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 2932F.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
3m modified semi-anechoic chamber	Frankonia	SAC3	G1811378	2022-06-27
Bilog antenna	Teseq	CBL 6112D	G1811425	2023-03-10
EMI test receiver	Rohde & Schwarz	ESCI	G1811402	2022-09-01
Spectrum analyser	Rohde & Schwarz	FSV40	G1822702	2023-11-04
Preamplifier	Taiwan EMCI	EMC184045SE	G1825372	2023-05-14
HF loop antenna	Schaffner	HLA6120	G1822700	2024-02-03
Log periodic antenna	Rohde & Schwarz	HL050	G1811417	2023-03-10
Broadband Horn Antenna	Schwarzbeck	BBHA 9170	9170-305	2023-07-08
Preamplifier	Taiwan EMCI	EMC051845SE	G1825371	2023-05-14
Spectrum Analyzer	Keysight	N9020A	MY54500180	2022-09-08

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Radiated Emission	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (equipments under test) is a TPMS Sensor which is working on 433.92MHz and 125kHz.

The aim of this report is to evaluate 433.92MHz transmitter of the EUT for FCC Part 15C.

For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Description of EUT	
Product Name:	TPMS Sensor
Model No.:	2D000689
Rated Voltage:	DC 3V (CR2032)
Technical Specification of Transmitter	
Frequency Range:	433.92 MHz
Modulation Type:	FSK
Antenna Type:	Internal Antenna
Technical Specification of Receiver	
Frequency Range:	125 kHz

3.3 Independent Operation Modes

Table 4: Independent Operation Modes

Test Mode	Channel Frequency [MHz]	Mode
TM1	433.92	Transmitting continually
TM2	433.92	Normal operation

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

4.3 Special Accessories and Auxiliary Equipment

Null.

4.4 Countermeasures to achieve EMC Compliance

Null.

5. Test Results

5.1 Conducted Testing at Antenna Port

5.1.1 Antenna Requirement

RESULT: **Pass**

According to the manufacturer declared, the EUT has one Internal antenna, the antenna is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Table 5: Antenna Requirement

FCC 15.203 – Antenna Requirement 1	
Requirement:	No antenna other than that furnished by the responsible party shall be used with the device
Results:	Antenna type: Internal Antenna
Verdict:	Pass

FCC 15.204 – Antenna Requirement 2	
Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.
Results:	Only one monopole antenna can be used
Verdict:	Pass

RSS-Gen 6.4 – External Control	
Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the regulatory requirements, including RSS-Gen and the applicable RSSs
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.
Verdict:	PASS

RSS-Gen 6.8 – Antenna Requirement

Requirement: When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

Results:

a) Antenna Type:	Internal Antenna
b) Manufacture:	N/A
c) Model No.:	N/A
d) Gain with reference to an isotropic radiator:	N/A

Verdict: PASS

5.1.2 20dB & 99% Bandwidth

RESULT:

Pass

Date of testing	: 2021-12-20
Ambient temperature	: 21.3°C
Relative humidity	: 49.2%
Atmospheric pressure	: 101kPa
Test requirement	: FCC Part 15.231(c) RSS-210 Issue 10, December 2019, A.1.3
Test procedure	: ANSI C63.10: 2013
Test voltage	: DC 3V
Test modes applied	: TM1

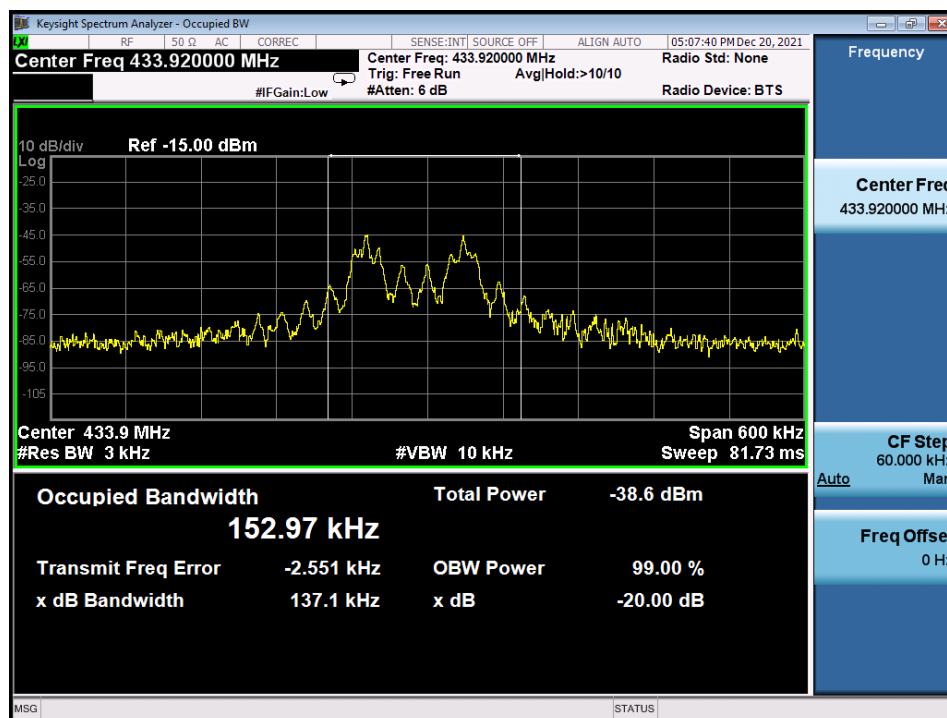
Table 6: 20dB & 99% Bandwidth

Channel Frequency [MHz]	20dB Bandwidth [KHz]	Limit [KHz]	99% Bandwidth [KHz]	Result
433.92	137.1	≤1084.8	152.97	Pass

Note:

$$\text{Limit} = 433920 \text{ KHz} \times 0.25\% = 1084.8 \text{ KHz}$$

Figure 1: 20dB & 99% Bandwidth



5.1.3 Transmission Time / Silent Period

RESULT:

Pass

Date of testing	:	2022-02-25
Ambient temperature	:	22.3°C
Relative humidity	:	53.5%
Atmospheric pressure	:	101kPa
Test requirement	:	FCC Part 15.231(e) RSS-210 Issue 10, December 2019, A.1.4(b)
Test procedure	:	ANSI C63.10: 2013
Test voltage	:	DC 3V
Test modes applied	:	TM2

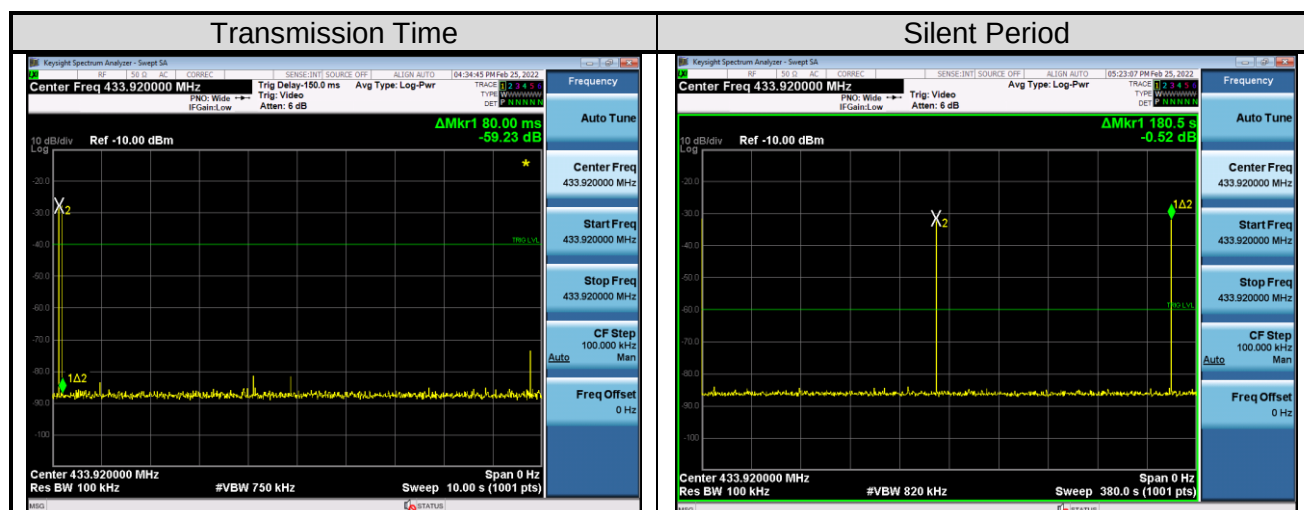
Table 7: Transmission Time / Silent Period

Channel Frequency (MHz)	Transmission Time [s]	Limit [s]	Result
433.92	0.08	<1	Pass
Channel Frequency (MHz)	Silent Period [s]	Limit [s]	Result
433.92	180.5	>10	Pass

Note:

Limit: the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds

Figure 2: Transmission Time / Silent Period



5.1.4 Conducted Emission

RESULT:**N/A**

Test requirement : FCC Part 15.207 (a)
RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.8

Test procedure : ANSI C63.10: 2013

Note:

This product is power by battery.
So, this test is not applicable

5.1.5 Field strength of fundamental and Radiated Spurious Emission

RESULT:

Pass

Date of testing : 2021-12-13 ~ 2021-12-22
 Ambient temperature : 22.4°C ~ 24.3°C
 Relative humidity : 47.1% ~ 56.9%
 Atmospheric pressure : 101kPa
 Test requirement : FCC Part 15.205
 FCC Part 15.209
 FCC Part 15.231(e)
 RSS-210 Issue 10, December 2019, A.1.4(d)
 RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.9
 Test procedure : ANSI C63.10: 2013
 Test voltage : DC 3V
 Test modes applied : TM1 for Field strength of fundamental and Radiated Spurious Emission
 TM2 for Duty Cycle

Table 8: Duty Cycle

Frequency [MHz]	Total Time (Ton) [ms]	The duration of one cycle [ms]	Duty Cycle	Duty Cycle Factor [dB]
433.92	15.2	100	15.2%	-16.36

Note: Duty Cycle Factor = 20*Log(Duty Cycle)

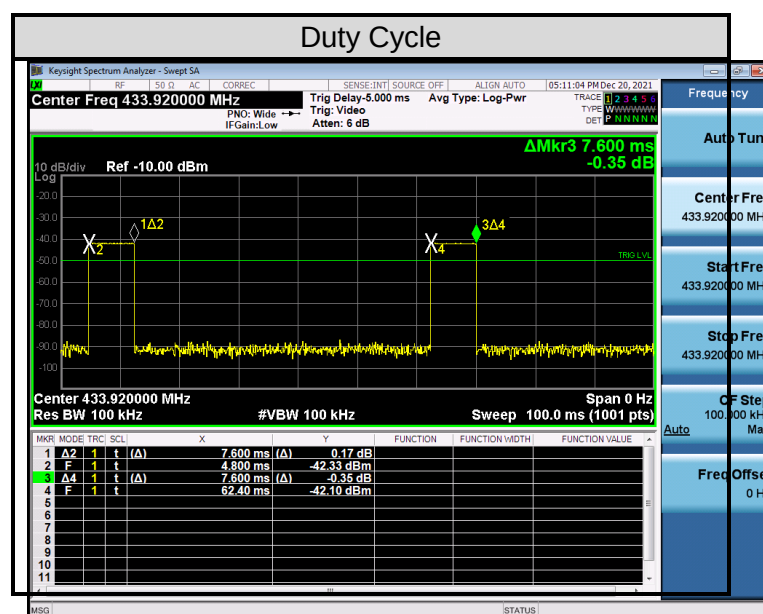
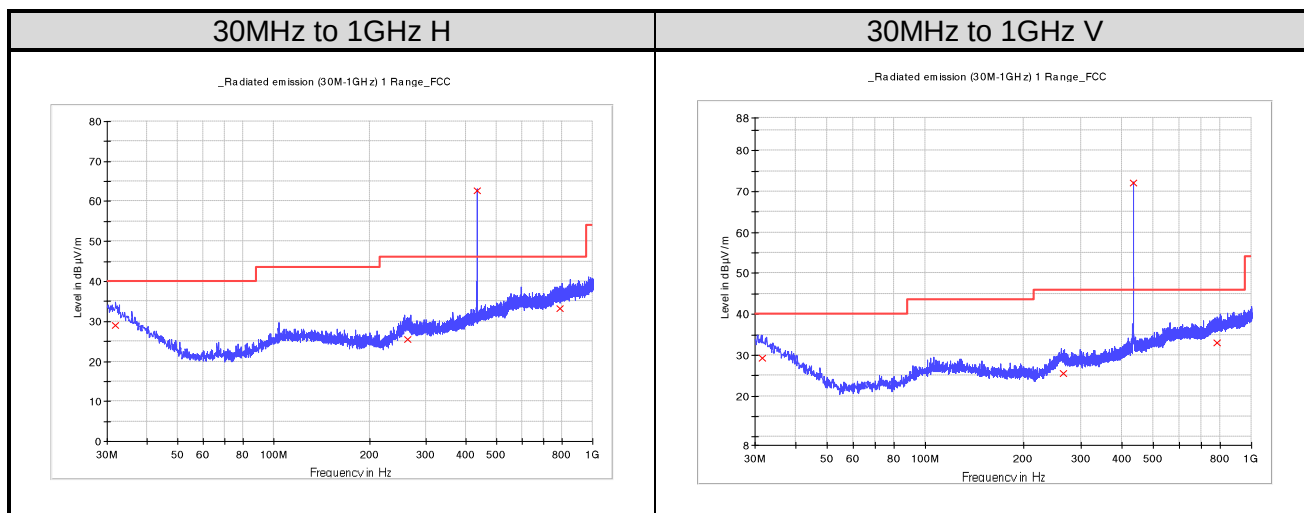
Figure 3: Duty Cycle


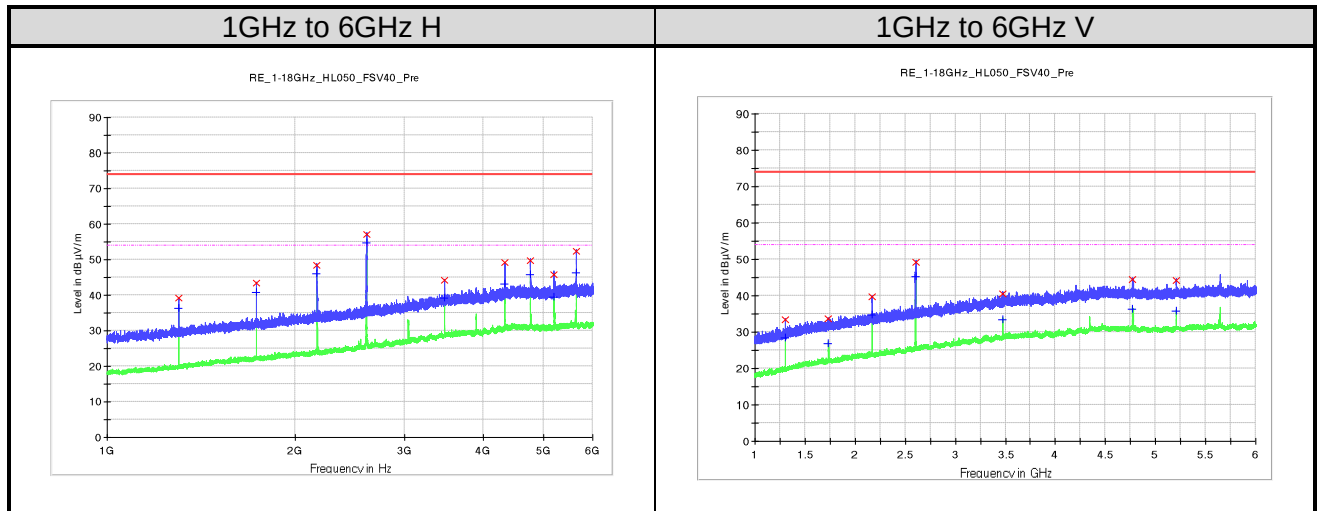
Figure 4: Field strength of fundamental and Radiated Spurious Emission, 30MHz to 1GHz


Limit and Margin

Frequency [MHz]	MaxPeak [dBuV/m]	Duty Cycle Factor [dB]	Average [dBuV/m]	Limit [dBuV/m]	Over Limit [dB]	Type	Pol.
31.940000	29.0	N/A	N/A	72.86	-43.86	QP	H
262.072500	25.5	N/A	N/A	72.86	-47.36	QP	H
433.883750	62.8	N/A	N/A	92.86	-30.06	PK	H
433.883750	62.8	-16.36	46.4	72.86	-26.42	AV	H
790.237500	33.2	N/A	N/A	72.86	-39.66	QP	H

Frequency [MHz]	MaxPeak [dBuV/m]	Duty Cycle Factor [dB]	Average [dBuV/m]	Limit [dBuV/m]	Over Limit [dB]	Type	Pol.
31.576250	29.2	N/A	N/A	72.86	-43.66	QP	V
265.103750	25.5	N/A	N/A	72.86	-47.36	QP	V
433.883750	72.1	N/A	N/A	92.86	-20.76	PK	V
433.883750	72.1	-16.36	55.7	72.86	-17.12	AV	V
782.598750	33.0	N/A	N/A	72.86	-39.86	QP	V

Note: Average Level= MaxPeak Level + Duty Cycle Factor

Figure 5: Field strength of fundamental and Radiated Spurious Emission, 1GHz to 6GHz


Limit and Margin

Frequency [MHz]	MaxPeak [dBuV/m]	Duty Cycle Factor [dB]	Average [dBuV/m]	Limit [dBuV/m]	Over Limit [dB]	Type	Pol.
1301.250000	39.1	N/A	N/A	72.86	-33.76	PK	H
1301.250000	39.1	-16.36	22.74	52.86	-30.12	AV	H
1735.500000	43.4	N/A	N/A	72.86	-29.46	PK	H
1735.500000	43.4	-16.36	27.04	52.86	-25.82	AV	H
2169.500000	48.5	N/A	N/A	72.86	-24.36	PK	H
2169.500000	48.5	-16.36	32.14	52.86	-20.72	AV	H
2603.750000	57.2	N/A	N/A	72.86	-15.66	PK	H
2603.750000	57.2	-16.36	40.84	52.86	-12.02	AV	H
3471.000000	44.3	N/A	N/A	72.86	-28.56	PK	H
3471.000000	44.3	-16.36	27.94	52.86	-24.92	AV	H
4339.000000	49.1	N/A	N/A	72.86	-23.76	PK	H
4339.000000	49.1	-16.36	32.74	52.86	-20.12	AV	H
4773.500000	49.8	N/A	N/A	72.86	-23.06	PK	H
4773.500000	49.8	-16.36	33.44	52.86	-19.42	AV	H
5206.250000	45.9	N/A	N/A	72.86	-26.96	PK	H
5206.250000	45.9	-16.36	29.54	52.86	-23.32	AV	H
5641.500000	52.4	N/A	N/A	72.86	-20.46	PK	H
5641.500000	52.4	-16.36	36.04	52.86	-16.82	AV	H

Note: Average Level= MaxPeak Level + Duty Cycle Factor

Limit and Margin

Frequency [MHz]	MaxPeak [dBuV/m]	Duty Cycle Factor [dB]	Average [dBuV/m]	Limit [dBuV/m]	Over Limit [dB]	Type	Pol.
1301.500000	33.4	N/A	N/A	72.86	-39.46	PK	V
1301.500000	33.4	-16.36	17.04	52.86	-35.82	AV	V
1735.000000	33.7	N/A	N/A	72.86	-39.16	PK	V
1735.000000	33.7	-16.36	17.34	52.86	-35.52	AV	V
2169.500000	39.8	N/A	N/A	72.86	-33.06	PK	V
2169.500000	39.8	-16.36	23.44	52.86	-29.42	AV	V
2603.500000	49.3	N/A	N/A	72.86	-23.56	PK	V
2603.500000	49.3	-16.36	32.94	52.86	-19.92	AV	V
3470.750000	40.6	N/A	N/A	72.86	-32.26	PK	V
3470.750000	40.6	-16.36	24.24	52.86	-28.62	AV	V
4773.250000	44.6	N/A	N/A	72.86	-28.26	PK	V
4773.250000	44.6	-16.36	28.24	52.86	-24.62	AV	V
5207.500000	44.3	N/A	N/A	72.86	-28.56	PK	V
5207.500000	44.3	-16.36	27.94	52.86	-24.92	AV	V

Note: Average Level= MaxPeak Level + Duty Cycle Factor

6. List of Tables

Table 1: List of Test and Measurement Equipment	5
Table 2: Measurement Uncertainty	5
Table 3: Technical Specification of EUT	6
Table 4: Independent Operation Modes.....	6
Table 5: Antenna Requirement	9
Table 6: 20dB & 99% Bandwidth.....	11
Table 7: Transmission Time / Silent Period.....	12
Table 8: Duty Cycle	14

7. List of Figures

Figure 1: 20dB & 99% Bandwidth	11
Figure 2: Transmission Time / Silent Period	12
Figure 3: Duty Cycle	14
Figure 4: Field strength of fundamental and Radiated Spurious Emission, 30MHz to 1GHz	15
Figure 5: Field strength of fundamental and Radiated Spurious Emission, 1GHz to 6GHz	16